DISSERTATION ON

"A STUDY ON THE ACCURACY OF ALVARADO SCORING SYSTEM IN THE DIAGNOSOSIS OF ACUTE APPENDICITIS"

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In partial fulfillment of the regulations

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THANJAVUR-613 004

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CERTIFICATE

This is to certify that the dissertation entitled **"A STUDY ON THE ACCURACY OF ALVARADO SCORING SYSTEM IN THE DIAGNOSIS OF ACUTE APPENDICITIS",** is a bonafide record of work done by **Dr.M.JEDIDIAH SAMRAJ**, in the Department of Surgery, Thanjavur Medical College Hospital, Thanjavur, during his post-graduate course 2012-2015. This is submitted in partial fulfillment for the award of M.S., degree examination, Branch I (General Surgery) to be held in April 2015 under The Tamil Nadu Dr. M. G. R. Medical University, Chennai.

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DECLARATION

I declare that this dissertation entitled **"A STUDY ON THE ACCURACY OF ALVARADO SCORING SYSTEM IN THE DIAGNOSOS OF ACUTE APPENDICITIS"** is a record work done by me in the Department of General Surgery,Thanjavur Medical College Hospital, Thanjavur, during my Post-Graduate course from 2012-15 under the guidance and supervision of **Prof. Dr. M. Elangovan. M.S.,** my Unit Chief, **Prof. Dr. V. Balakrishnan. M.S.,** Professor and Head of the Department, Department of General Surgery, Thanjavur Medical College. It is submitted in partial fulfillment for the award of M.S., degree examination, Branch I (General Surgery) to be held in April 2015 under The Tamil Nadu Dr. M. G. R. Medical University, Chennai.

This work has not been submitted previously by me for the award of any degree or diploma from any other university.

Place : Thanjavur. **Dr.M.Jedidiah Samraj.**

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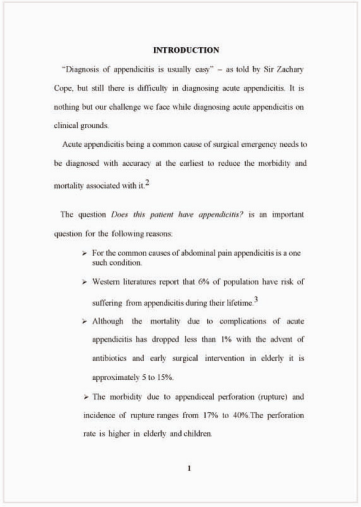

INTRODUCTION

"Diagnosis of appendicitis is usually easy" – as told by Sir Zachary Cope, but still there is difficulty in diagnosing acute appendicitis. It is nothing but our challenge we face while diagnosing acute appendicitis on clinical grounds.

Acute appendicitis being a common cause of surgical emergency needs to be diagnosed with accuracy at the earliest to reduce the morbidity and mortality associated with it.[2]

The question *Does this patient have appendicitis?* is an important question for the following reasons:

- For the common causes of abdominal pain appendicitis is a one such condition.
- Western literatures report that 6% of population have risk of suffering from appendicitis during their lifetime.[3]
- Although the mortality due to complications of acute appendicitis has dropped less than 1% with the advent of antibiotics and early surgical intervention in elderly it is approximately 5 to 15%.
- The morbidity due to appendiceal perforation (rupture) and incidence of rupture ranges from 17% to 40%.The perforation rate is higher in elderly and children.

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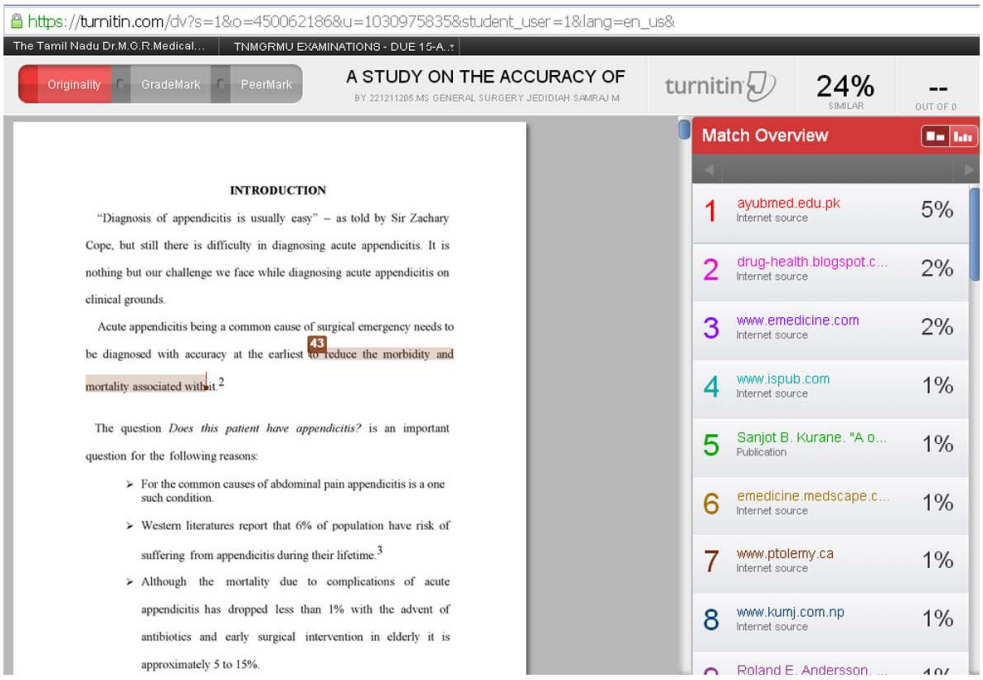
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ABSTRACT

Background is Objective

Acute appendicitis is the most common surgical emergency .Failure to make an earlier diagnosis leads to complications like perforation and intra abdominal abscess. The objectives of the study are

1) To study the accuracy of the Alvarado score system in the diagnosis of acute apprndicitis by comparing with the histopathological examination report of removed appendix.
2) To compare the negative laparotomy in this study against other study

Methods

The study population consists of patient admitted with pain in the right iliac fossa and the diagnoses of acute appendicitis was confirmed by investigations like ultra sonogram abdomen and CT abdomen. The severity of the acute appendicitis is scored by Alvarado score and the patients were managed according to the severity.

Results

Most cases acute appendicitis presented with right iliac fossa pain and it was commoner in younger age group. Patients with higher Alvarado score were considered to have acute appendicitis. Such patients were initially resuscitated and the taken for emergency appendicectomy. .Early

surgical intervention reduced the morbitidy and mortality associated with acute appendicitis. Those patients with lesser scores were managed conservatively and discharged home.

Interpretation and Conclusion

Alvarado scoring system has a higher sensitivity and positive predictive value. Thus scoring system is a dynamic one, allowing observation and re evaluation of clinical picture. Its value in decision making is high both in males and females. In females the reason is multifactorial and diagnostic laparocopy is essential. Its application improves diagnostic accuracy and considerably reduces the negative laparotomy rate. The score system is quite and cost effective.

KEY WORDS

Acute appencitis, Alvarado score, emergency appendicectomy.

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- The morbidity due to appendiceal perforation (rupture) and incidence of rupture ranges from 17% to 40%.The perforation

rate is higher in elderly and children.

- Failure to make an early diagnosis leads on to complications like perforation, which in turn leads on intra abdominal abscesses.
- The negative laparotomy rate ranges from 15% to 35% and is associated with significant morbidity.[4,5] The negative laparotomy rate is significantly higher in young women (upto 45%) because of prevalence of pelvinflammatory disease (PID) and other common obstetrical and gynaecological disorders.[4,5]
- Thus, diagnosing acute appendicitis accurately is very important to decrease complications following appendicitis and the morbidity and mortality associated with it.

Routine history & physical examination remains the most effective and practical diagnostic modalities.[7] The typical history is onset of generalized abdominal pain followed by anorexia and nausea. Typically, the patient presents with central abdominal pain shifting to the right lower quadrant. Vomiting may happen at this time, especially in children. Depending on the severity of inflammation physical examination will reveal signs similar to

any acute intra-abdominal process-local rebound tenderness, muscle guarding, rigidity, cutaneous hyperesthesia, and tenderness on rectal examination. Since, about a third of all patients with acute appendicitis present with atypical symptoms, [4,8] the differential diagnosis is varied such as gastroenteritis, regional enteritis, ovarian &tubal disorders (in young women), Ureteric colic, peptic ulcer, diverticulitis, mesenteric adenitits , cholecystitis.

The routine laboratory examination of blood and urine is mandatory. In old patients elevated leukocyte count with shift to left may be absent and it is usual finding in others.[4] C - reactive protein is a non specific indicator of acute inflammatory conditions. Estimation of CRP may help to support surgeon's clinical diagnosis and to reduce negative appendicectomies.[10, 11]

The roentgenogram findings like

1) Faecolith
2) Dilated loop of ileum – due to local ileus
3) Air fluid level in caecum
4) Haziness in right lower quadrant
5) Blurring of Psoas shadow
6) Gas under the diaphragm due to perofration

Among these the important findings are air fluid level in the terminal ileum and dilatation of a loop of ileum. Both have a speficity of around 95%and 78% and sensitivity around 51% and 62%.

Contrast studies like barium enema, the major risk being the caecal perforation, findings are often negative in such condition. Such findings are also negative if the appendix got perforated, moreover it is

- Time consuming for the radiologist.
- Uncomfortable for the patient.
- Entails ionizing radiation

Ultrasonogram with high frequency probe is useful in diagnosis of acute appendicitis but it has its own limitation. There are many prospective studies published which showed that findings in ultrasonogram were important and it is used to help the surgeons to arrive at the decision to operate. These studies showed an overall accuracy of 87 to 96% with a sensitivity of around 94% and specificity of around 86% to 100%. Blind ending tubular structure will give clue clue for diagnosis and probe tenderness is an additional feature in USG.

Computerized tomogram also ha s its limitation like radiation exposure and presence of fluid in right iliac fossa to diagnose acute appendicitis. Laparoscopy has been shown by some authors to be particularly useful in young women in reproductive age because gynaecological conditions may mimic acute appendicitis. The rate of diagnostic error is twice as high in women of reproductive age as that in men.

Inspite of the advanced imaging modalities, the rate of negative laparotomies is around 15-25%. The complication rate of appendicectomy for a non inflamed appendix is also same as that of inflamed appendix. It is around 13%.

The mortality rate of appendicectomy is around 0.65 for every 100 surgeries. Considering the mortality and the complications associated with appendicectomy, if the patient is managed conservatively, the delay in the intervention leads to perforation of appendix in around 28%.

Alvarado A described the **scoring system** in 1986. M. Kalan, D. Tabot,WJCulliffe and AJ Rier in 1994 later modified it by taking one laboratory finding of the scoring system. The Alvarado scoring system in patients with pre- operative clinical diagnosis of

appendicitis has been useful in the early diagnosis of acute appendicitis as demonstrated by various studies and was helpful in reducing the incidence of negative appendicectomies without increasing the morbidity and mortality.

OBJECTIVES

- To study the accuracy of Alvarado scoring system in the diagnosis of acute appendicitis by comparing with the histopathological examination report of removed appendix specimen

- To compare the negative laparotomies in this study against other studies.

REVIEW OF LITREATURE

The word "appendicitis" refers to inflammation of appendix veriformis. The literal meaning of appendix is an appendage – anything that is attached to a larger or major part as a tail or limb. The Latin word, Appendices vermiformis is a worm shaped tubular structure araisng from the posteriomedial aspect of the caecum and about 2cm below the terminal ileum. It is confined almost entirely to humans and the higher primates, and occasionally be absent in humans.

HISTORICAL NOTE:

Though the presence of the appendix has been known for centuries, the credit for its first description goes to the physician-anatomist, BerengarioDaCapri, in the year 1521. In 1492 Leonardo davinci clearly depicted the appendix in his anatomic drawings. Though it was depicted in 1492 it came to light in 18tn century, and was well illustrated in the AndreasVesalius work, "De HumaniCorporisFabrica," published in 1543.

EVOLUTION OF APPENDICITIS:

The disease appendicitis has been known for centuries. Aretaeus in the second century A.D. described a case in which he drained an abscess of the right part of the abdomen near the liver. This might have been a description of an abscess arising from some other source.

Jean Fernel, the great French Physician, described a case of perforated appendicitis in his UniversaMedicina, which was published in 1554. He gave an account of a seven- year old girl who had diarrhea for several days and her grandmother gave her a large quince. It stopped her diarrhoea, but the girl began to have severe abdominal pain and eventually she died. At autopsy the "caecum intestinum was narrow and constrticted; also quince was found adherent to the inside and stopping of the lumen".

In 1711 Lorenz Heister, professor of surgery at Helmstadt discovered a case of appendicitis when he was called to dissect the body of a criminal who had been executed. In account he wrote later that as he was "about to demonstrate the situation of the great guts, found the vermiform process of the caecum preternaturally black, adhering closer to the peritoneum than usual."[29]

William Ballonius, in his Consiliorum Medicinalium published in Geneva in 1734, gave the description of gangrenous appendicitis in the living patient, although he did not use this term.

Sir Zachary Cope in his book "A history of Acute Abdomen", has reported this. John Parkinson and Wegelar of England

& Oliver Prescott of New England reported perforation of appendix in 1812. However, J.B.Louyer-Villermay in 1824 emphasized the importance of the condition in his paper, "Observations of Use in the inflammatory Conditions of the Caecal Appendix" which was presented in the Royal academy of medicine in Paris. Walcott Richard's diagnosis of perforation of appendix, which he described as "ulceration of the appendix veriformis" in 1838, was confirmed on autopsy.29

During the nineteenth century, the caecum was considered as the chief cause of trouble .All the diseases in the right lower quadrant was attributed to caecum. The diseases of caecum and appendix were considered to be same.All the troubles of the right lower quadrant were termed under the term typhlitis, or inflammation of the caecum. Husson and Dance in 1827, Goldbeck in 1830 and Dupuytren in 1835 developed the concept of inflammation arising in the cellular tissue surrounding the caecum. It was Goldbeck who confined the term "perityphlitis"[26]. Later J.F.H.Albers of Bonn described four varieties of typhlitis in 1837, influencing medical thought for 50 years.[29]

Frederick Merling in the study of the pathologic anatomy of the appendix published in 1838 reported that a foreign body has been found in the appendix and was thought to have caused gangrene. Since then much has been written about foreign bodies in the appendix and are blamed for perforations.[29]In 1965 R.E.Shaw reported that the stones found in the appendix are true calculi, not just faecoliths. He said that calculous appendicitis was more apt to gangrene and perforation.[29]

Reginald Fitz of Boston gave his classical paper on appendix before the Association of American Physicians in 1863. His paper was based on an analysis of 257 cases of perforating ulcer of appendix and of 209 cases clinically diagnosed as typhlitis and perityphliticabcess. The disease was found to be most common in youngadults, especially males. A faecal concretion or foreign body was present in three-fifths of cases. He went on to discuss the origin of the term typhlitis, perityphlitis and paratyphlitis abscess and concluded that in vast majority of cases the primary cause was inflammation of the appendix. He preferred the term "appendicitis" to all others. He wrote "in most cases of typhlitis, the caecum is intact whilst the appendix is ulcerated and perforated." Surgeons in the United States discarded the old term of typhlitis in the 1890's and after the 19th century the appendix was considered to be the

cause of inflammations in the right iliac fossa, and the previous concept of caecum was discarded.

In1899 Charles Mcburney of New York illustrated that "exact locality of the maximum tenderness, when one examines with the fingertips in adults, is one-half to two inches inside the right anterior spinous process of the ileum on the line drawn to the umbilicus. The accuracy of this sign (Mcburney's point), I have demonstrated in every case operated upon by me since I first made the observation"[29]. This point corresponds to the base of the appendix and therefore does not move with the tip.

EVOLUTION OF APPENDICECTOMY:

According to R.G.Richardson in "The Surgeons Tale", the first appendicectomy was performed at St.Georges Hospital, London, in 1726 by Claudius Amyand. The patient, a boy, had hernia and a faecal fistula. Richardson reported: "When he opened the scrotum he found the appendix in the unusual position and moreover, that the appendix was perforated by a pin. He removed the appendix and then dealt with the hernia and fistula".[26]

Hancock in London successfully drained an appendix abscess in a female patient aged 30 years that was in her eighth month of pregnancy in 1848. After incising the peritoneum, fluid was drained and he made no search for the appendix.[29]Willard Parker, an American surgeon, started draining appendiceal abscesses since 1867. He did not remove the appendix and his technique is still used but the appendix is removed later on.[29]

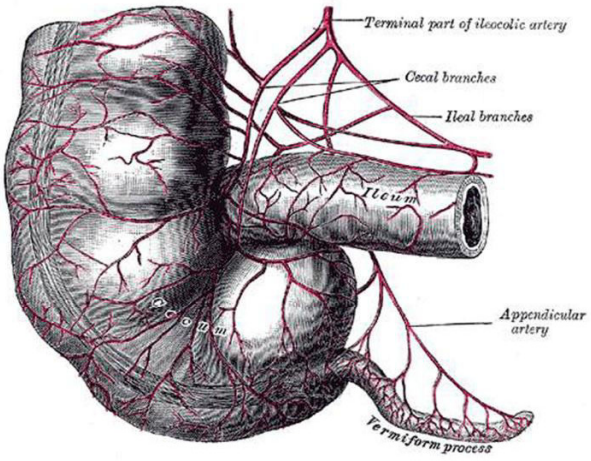
Lawson Tait, the great English surgeon, was the first to remove an acutely inflamed appendix.[26].He thought that his patient had a general peritonitis resulting from rupture of caecum or appendix. However, when he opened the abdomen he found "a large abscess which extended deeply down towards the brim of the pelvis lying bare was the vermiform appendix which was black and discoloured and gangrenous". The patient made a perfect recovery following appendicectomy and drainage of abscess.[29]

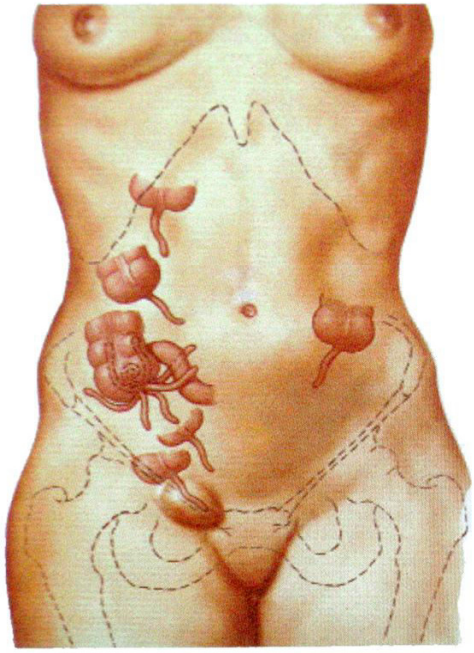
Abraham Groves performed the first elective appendicectomy in Canada in 1883. His patient was a twelve- year old boy. The appendix was removed and the stump was cauterized with a heat probe heated over the flame of a lamp. The patient recovered. Early operation for appendicitis was widely promulgated by surgeons like John Deaver

(1855-1931), Charles Mcburney (1845-1913) and Murphy of Chicago.[25] In 1894, Mcburney described his incision for appendicectomy. Though he wasthe first to describe this incision, L.L.McArthur, who had used the incision in more than 60 cases[29], had used it for a longer time. Later McBurney gave McArthur credit for using the incision first, but despite this, it is still known as the Mcburney's incision.

Later others modified the incision like Rutherford Morison in 1896, A.E.Rockey in 1905, and G.G.Davis in 1906.[28] Noteworthy as these various dates are, it is doubtful whether any of them areas important in the history of the appendicectomy as 24th June 1902. The coronation of King Edward VII had been arranged to take place on 26thJune 1902, but the king fell ill with abdominal pain and fever only a few days before, At a consultation of some of the most distinguished surgeons in the land, including Lord Lister, it was decided that the only chance to save his life lay in urgent operation. Frederick Treves, who had performed his first successful appendicectomy in 1887, opened the abdomen and drained an appendix abscess on 24th June 1902. The king made a good recovery and the operation was entirely successful. After the postponed coronation on 9thaugust 1902, Treves received a knighthood and Lister was made a Privy Councillor and one of the 12

original members of the Order of Merit. When welcoming Lister to his Council, the king is supposed to have said, 'I know that is it had not been for you and your work, I would not have been here today'[29].





ANATOMY OF APPENDIX

ANATOMY:

Embryologically, the vermiform appendix is the part of the caecum, which forms the blind end. It develops from the caudal part of the midgut loop. A line is dawn from the anterior superior iliac spine and the umbilicus. The junction of the medial two third and the lateral one third is considered to be the proposed site of the base of the appendix as described by McBurneys and it is called as Mc Burneys point. Intra operatively the confluence of the taenia is used to identify the base of the appendix.

Its length varies from 2cm to 20cm, with average length of 9cm. It may occupy one of the several positions, thus it may be retrocaecal, retrocolic, pelvic or descending over the pelvic brim, in close relation to the right uterine tube and ovary. Other positions are occasionally seen especially when there is a long appendix mesentery allowing greater mobility which include subcaecal, preileal and postilieal.

It has a mesoappendix with which it is attached to the ileal mesentery. The lumen of the appendix is small (admits a matchstick). The opening of the appendix into the caecum usually lies below and posterior to the illeocaecal opening. The illeocaecal valve is nothing but a mucosal fold which gaurds it and is not patent in all.

Appendicular artery is a branch of illeocolic artery and it runs in

the free border of the meso appendix. It is usually the only supply for the appendix. The base of the appendix lies in close association with the appendicular artery and hence any inflammation will cause gangrene of the appendix.

The recurrent appendicular artery araises from the posterior caecal artery and it usually lies near the base of the appendix. If recurrent appendicular artery is present it may anastamose with the appendicular artery.

The venous drainage of the appendix is by appendicular vein which drains into the illeocolic vein and in turn drains into the superior mesenteric vein.

There is an about four to six lymphatic channel that drains into the illeocolic node.

The symphathetic and parasymphathetic nerve supply to the appendix is from superior mesenteric plexus.

Histologically appendix contains the following layers

1) Mucosa
2) Submucosa
3) Muscularis externa

4) Serosa

Mucosa:

The epithelium of the mucosa contains the following cells

1) Columnar cells
2) Mucous cells
3) Stem cells
4) Microfold cells
5) Neuroendocrine cells

Crypts of the appendix is larger and numerous. Each crypt is lined columnar epithelium with mucous cells, neuroendocrine cells, microfold cells and stem cells at the base.

Lamina propria:

It is made up of connective tissue that supports the epithelium. The speciality is lamina propria of the appendix is rich in solitary lymphoid follicles.

Muscularis mucosa: Muscularis mucosa contains circular and longitudinal muscle fibres.

Muscularis externa: it contains inner circular and outer longitudinal muscle fibres

Serosa:

The appendix contains serosa except the place where the mesoappendix is attached.

Though the physiologic role of the appendix is unproved and immunologic function is suggested by its content of lymphoid tissue. Nevertheless, it is a useful organ for surgeons as it can be used for on table lavage of large bowel. It can also be used as a conduit for permanent continent urinary diversion.

The position of the appendix can be anywhere along the arc with the centre at the base of the caecum.[23] It is the only organ in the body that has no constant anatomic position; in fact, its only constant feature is its mode of origin from the ceacum. The various positions of the appendix are: paracolic, retrocolic, preileal, postileal, promontoric, pelvis and subcaecal. In situs inversus the appendix may lie in the left iliac fossa.

The position of the appendix as given by Sir C wakeley

1) Retrocaecal 74%
2) Pelvic 21%
3) Paracaecal 2%
4) Sub caecal 1.5%
5) Post illeal 0.5%

ACUTE APPENDICITIS:

Incidence

Acute Appendicitis is one of the most common causes of the acute surgical abdomen.[8,26] ·But since the disease is not notifiable, its exact incidence is not known. There is an increase in the incidence of acute appendicitis in Europe, America, and Australia. The rate of appendicectomies in this population is around 16%. In the recent past there is a decline in the incidence of acute appendicitis in these countries with the appendicectomy rate of around 8.6%and 6.7% for males and females respectively.

In England the total number of appendicectomies falls from 1,13,000 to 48,000 in the 20th century. There has been an annual decrease of 17% in the numbers of appendicectomies performed between 1987&1996 in Sweden. Appendicitis has shown an association with western diet habits. It is also believed that there is a familial tendency in this disease that could be explained to be due to an inherited malformation of the organ. Anderson & colleagues compared 29 children between the ages of 5 and 15 years suffering from appendicitis with 29 controls. Twenty in the study group compared with four in the controls gave a history of appendicitis in

parents and siblings.[28]However, family history of appendicitis has no diagnostic value.

Pathology

Acute appendicitis is thought to arise from infection superimposed on luminal obstruction. The lumen of the appendix becomes obstructed by hyperplasia of submucus lymphoid follicles, fecolith, stricture, tumor, or any pathological condition. Once obstruction occurs, continous mucus secretion and inflammatory exudation increases intraluminal pressure, obstructing lymphatic drainage. Oedema and mucosal ulceration develops with bacterial translocation to the submucosa. Resolution may occur at this point either spontaneously or in response to antibiotic therapy. If this condition progresses, further distention of the appendix may cause venous obstruction and ischemia of the appendix wall. With ischemia, bacterial invasion occurs through the muscularispropria and sub mucosa, producing acute appendicitis. Finally ischemic necrosis of the appendix wall produces gangrenous appendicitis, with free bacterial contamination of the peritoneal cavity. Alternatively, the greater omentum and loops of small bowel become adherent to the inflamed appendix, walling of the spread of peritoneal contamination, resulting in a Appendicular mass or Appendicular abscess.[28] The bacteriology of the

normal appendix is similar to that of the normal colon. The appendiceal flora remains constant throughout life with the exception of Porphyromons gingivalis, which is seen in adults. The principal organisms seen in the normal appendix, in acute appendicitis, and in perforated appendicitis are Escherichia Coli and Bacteroides fragilis. However, a wide variety of both facultative and anaerobic bacteria and mycobacteria may be present. Appendicitis is a polymicrobial infection with some series reporting up to 14 different organisms cultured in patients with perforation. According to a study by Pieper and colleagues of the bacteriology of 50 inflammed appendices, both aerobic and anaerobic bacteria were isolated in all patients. Anaerobic isolates were more than aerobic, 141 versus 96 isolates. E.Coli were the most common aerobic bacterium (45 out of 50). Other gram negative aerobes like klebsiella, and proteus and pseudomonas were isolated in ten patients.[28]

Enterococci were found in 15 patients and streptococci in 21 paitents. Among the anaerobes, the most common was Bacteroides fragilis. Next in frequency were gram positive cocci. Clostridium perfingeus was isolated from 9 patients.[30]There are two types of acute appendicitis, Catarrhal & Obstructive appendicitis. Catarrhal appendicitis is initially a mucosal and submucosal inflammation. Externally; the appendix may be quite normal, or hyperemic in early stages. However the mucosa wall is thickened, edematous and reddened. Later it becomes

studded with dark brown hemorrhagic infarcts, patches of green gangrene, or small ulcers. Eventually the appendix becomes swollen and turgid and the serosa becomes roughened coated with fibrinous exudates, in these cases the lumen of appendix is patent and these cases rarely progress to gangrene. However the lymphoid hyperplasia may lead to obstruction of the lumen and proceed to gangrene. Furthermore, if the episode of catarrhal appendicitis resolves, adhesion formation and kinking of the appendix may lead to a final episode of acute obstructive appendicitis.[28]

Obstructive appendicitis is the dangerous type, since the appendix becomes a closed loop of bowel containing feacal matter. When the appendix gets obstructed, the appendix becomes distended with mucus in which the bacteria proliferate. Because of increase in intraluminal pressure, there is pressure atrophy of the mucosa and the bacteria invade the deeper tissue plane. The inflammation of the wall of the appendix leads to thrombosis of the vessels, as the appendix has an end arterial blood supply, gangrene occurs inevitably followed by perforation of the necrotic appendix wall.

Wilkie demonstrated the relationship between obstruction of the appendix and gangrenous appendicitis in 1914, which showed that acute

appendicitis followed ligation of the appendix in the rabbit.[31]Wangensteen and colleagues documented in 1937 and 1940 that combined obstruction and bacterial infection resulted in acute appendicitis.

In two third of all gangrenous appendicitis, feacolith is in the appendiceal lumen. A true fecolith is ovoid, about 1 to 2 cms in length, and fecal coloured. The great majority of these fecoliths are radioopaque and, in 10% of cases, contain sufficient calcium to be demonstrated on plain x-ray film of the abdomen. Other foreign bodies like food, debris, worms, or even gallstones have been found to obstruct the appendix lumen.[26]one of the rare causes of obstructive appendicitis is the appendix becoming strangulated in hernial sac. Thomas et al (1982) reported seven such cases.[34]

The most frequent site of perforation is along the antimesenteric border, usually near the tip, as the Appendicular artery is subserosal at this point and more prone to be involved in the inflammatory process and become thrombosed. After perforation a localized abscess may form in the right iliac fossa or the pelvis, or diffuse peritonitis may ensue. Whether the peritonitis remains localized or becomes generalized

depends on many factors, including age of the patient, the virulence of the invading bacteria, the rate at which he inflammatory condition has progressed within the appendix and the position of the appendix.[28] It is usually stated that the poorer localization of the infection occurs in infants because the omentum of the child is filmy and less able to form a protective sheath around the inflamed appendix. A more likely explanation is that delays in diagnosis are more prone to occur in infants. Similar delays occur in the management of elderly persons. Gangrenous appendix is more dangerous than the catarrhal type of appendicitis. An appendix situated in the retrocaecal position is more likely to form a local abscess than one in the pre ilieal or subcaecal position.[35]

The consequences of a perforated appendix are potentially severe in women of child bearing age. The relative risk of infertility is increased three to five times in a female patient with a history of a ruptured appendix.[36]

The entity of chronic or grumbling appendicitis is controversial.[28]It has been well said that "the appendix does not grumble – it either screams or remains silent." Both the clinical and experimental data support the belief that some patients have repeated attacks of appendicitis. In fact, it is not unusual for one or more such episodes to precede a full blown acute appendicits. In such cases, surgical specimens have shown chronic inflammatory infiltrates depending on whether the appendicectomy was performed during the attack or in between the bouts.[37]Thus the term chronic appendicitis has been used. But, it definitely does not mean prolonged abdominal pain lasting weeks or months.

CLINICAL MANIFESTATIONS

The diagnosis and management of acute abdominal pain remains one of the last bastions of clinical medicine. There is no other common situation where clinical features, accurate diagnosis, and immediate decision are of such importance. The diagnosis of acute appendicitis is made primarily on the basis of the history and the physical findings, with additional assistance from laboratory and radiographic examinations. In appendicitis, there is highly characteristic sequence of signs and symptoms.

The classical features of acute appendicitis begin with poorly

localized colicky abdominal pain. This is due to the midgut visceral discomfort in response to appendiceal inflammation and obstruction. The pain is frequently initially noticed in the epigastric or periumbilical region, presumably due to the distention of the appendix. This central abdominal pain is followed by anorexia, nausea and vomiting. With progressive inflammation of the appendix, the parietal peritoneum in the right iliac fossa becomes irritated, producing more intense, constant and localized somatic pain that begins to predominate. During the first 6 hours, there is rarely any alteration in temperature or pulse rate, after some time, slight pyrexia with corresponding increase in pulse rate is usual. Though the patient frequently complains of constipation especially during early phase of visceral pain, many patients particularly children may present with diarrhea. If the temperature is considerably raised (i.e.>103°F) at the very beginning attack then appendicitis is less likely unless there is perforation. And perforation is extremely uncommon before 24-36 hours of onset of symptoms.[38]

Physical findings are determined by the anatomic position of the inflamed appendix, as well as by whether the organ has already ruptured when the patient is first examined. The order of occurrence of the symptoms is of utmost importance.[38]Itwas J.B.Murphy who

recognized the importance of the sequence of symptoms. The march of event is

- Pain, usually epigastric or umbilical
- Anorexia
- Nausea or vomiting
- Tenderness
- Fever
- Leucocytosis

The sequence of symptoms of pain abdomen followed by vomiting and then by fever is termed as "Murphy's syndrome". If vomiting occurs before pain abdomen then the diagnosis of acute appendicitis is questionable and a peaceful night is assured to the surgeon.[24]Murphy stated: "The symptoms occur almost without exception in the above order, and when the order varies I always question the diagnosis." This dictum is usually true with occasional exceptions.

Tenderness in the right iliac fossa (RIF) is a very important sign. The early deep tenderness is almost always detected just below the joining of anterior superior iliac spine and the umbilicus. Tenderness over the Mcburney's point is not so constant which corresponds to the base of the

appendix, as the tenderness appears to be located actually in the appendix itself. In fact, the site of the tenderness varies somewhat according to the position of the appendix. Tenderness may be less in case of retrocaecal or post ileal appendix. With a retrocecal or a post ileal appendix, the anterior abdominal findings are less striking and tenderness maybe most marked in the flank. When the inflamed un-perforated appendix hangs over the brim of the pelvis or is lying wholly within the pelvis; In the so called 'silent appendix', abdominal findings may be entirely absent, and the diagnosis may be missed unless the rectum is examined, pain is felt in the suprapubic area ,as well as locally within the rectum.[24,26]

Peritoneal signs:

A)Mc Burney's sign: Finger tip pressure is made over the Mc Burney's point (i.e, at the junction of lateral third with medial two thirds of the right spino-umbilical line)**,** which if the sign is positive, registers the maximum abdominal tenderness.

B)Pointing test: When the patient is asked to point the site of pain this usually corresponds with the site of localized tenderness in McBurney's point.

C) Rovsings sign: Palpation of the left iliac fossa may produce pain in the right iliac fossa (crossed tenderness). This sign appears to be due to the shift of coils of ileum to the right impinging on an inflamed focus in the right iliac fossa

D)Cough Test: When the patient coughs vigorously and holds his or her right lower quadrant of the abdomen or refuses to cough because of pain, right lower quadrant peritonitis is confirmed.

E) Blumberg's sign or Rebound tenderness or Release sign: Pain on abrupt release of the palpating hand in the right iliac fossa suggests localized peritoneal irritation. However, since this exam causes severe pain to the patient, it should not be elicited frequently.

F) Cope's Psoas test: A retrocaecal appendix lies on the psoas major muscle. Inflammation of this causes irritation of psoas major muscle which is concerned with flexion of hip joint. The patient is turned to the left and the right thigh is extended. This initiates pain.

G) **Cope's obturatortest :**Internal rotation of hip in a patient with pelvic appendicitis, initiates pain as it lies over the obturator internus muscle.

H)Baldwing's sign : A hand is placed over the right flank and the patient is asked to raise the right lower limb with knee extended, in retrocaecal appendicitis this initiates pain and indicates the retrocecal position of the appendix.

Local hyperesthesia in the Sherren's triangle (this is formed by lines joining the umbilicus, right anterior superior iliac spine and symphysis pubis) is regarded as a good guide in diagnosis of gangrenous appendicitis. This nearly always lies in the area of distribution of the nerves from tenth, eleventh and twelfth dorsal and first lumbar spinal segments. Hyperaesthesia signifies that the inflamed appendix is, as yet, unperforated; when perforation occurs it passes off.

Guarding- a state of voluntary contraction and rigidity- a state of involuntary contraction are uncommon findings in the early stage. Rigidity is usually present in case of diffuse peritonitis due to perforation.

However, the accuracy of these signs in diagnosing appendicitis is not clear. Wagner et al did the systematic review of literatures

regarding evaluation of the accuracy of the clinical presentation of appendicitis. Three findings show a high positive likelihood ratio (LR+) and, when present are most useful for identifying patients at increased likelihood for appendicitis: right lower quadrant pain (LR+=8.0), rigidity (LR+=4.0) and the migration of pain to right lower quadrant (LR+=3.1). Unfortunately, no single component consistently provided a low negative likelihood ratio (LR-) that would rule out appendicitis. The absence of right lower quadrant pain and the presence of similar pain in the past demonstrate powerful negative LRs (0.2and 0.3, respectively)

In another prospective study39, the diagnostic value of 21 elements of the history, clinical findings, body temperature and laboratory examinations were assessed and compared in 496 patients with suspected appendicitis. No single variable had sufficiently high discriminating or predicting power to be used as a true diagnostic test. But, the independent predictors of appendicitis were total leukocyte and differential counts, CRP concentrations, rebound tenderness, abdominal guarding and patient gender.

This study showed that the element of disease history had low power in discriminating for appendicitis and advanced appendicitis. However, the elements of clinical findings had better discriminating

power than history except the site of tenderness. A family history of appendicitis, previous experience of similar symptoms, anorexia, nausea, constipation, diarrhea or the progression of pain had no diagnostic value for appendicitis. Right sided rectal tenderness was found to be a predictor of negative exploration.

DIFFICULTY IN DIAGNOSIS

SPECIAL FEATURES

RETROCAECAL:

Localised rigidity is often absent and tenderness may not be elicited by deep pressure. In retro-caecal appendix, it lies above the caecum, which is filled with gas, prevents the pressure exerted by the hand from reaching the inflamed structure. Rigidity of Quadratus lumborum and Psoas muscle can occur. Flexion of the hip can occur due to the contact of the inflamed appendix with the psoas muscle.

PELVIC:

If the appendix being pelvic in position, abdominal rigidity, Mc Burneys point tenderness will be absent. Diarrhoea can occur due to irritability of the rectum by the inflamed appendix which lies close to it. If the inflamed appendix lies close to the bladder, it can cause increased frequency of micturition.

POST ILLEAL:

Inflamed appendix lies behind the ileum. Migration of pain to right iliac fossa will not occur in post illeal appendix. It may present like diarrhoea with marked retching. There will be illdefined tenderness at the level of umbilicus.

SPECIAL FEATURES ACCORDING TO AGE

Infants:

Appendicitis is rare in infants below 36 months of age. If acute appendicitis occurs in infants it is severe because of delay in the diagnosis, which leads to the occurrence of perforation and postoperative complications.

If the appendicitis in children causes localized peritonitis, it will eventually lead on to generalized peritonitis due to underdeveloped greater omentum.

Children:

In children with acute appendicitis, vomiting will be an important symptom. Other important symptom is complete aversion to food.

Elderly:

In elderly patient due to lax abdominal wall, guarding may not be that much manifested. Acute appendicitis with gangrene and perforation are common in elderly. Sometimes in elderly the clinical picture may be like that of subacute intestinal obstruction.. All the above said reasons lead to delay in the diagnosis of acute appendicitis in elderly population leading to considerable morbidity and mortality.

Pregnancy:

In pregnancy acute appendicitis is one of the most common emergency conditions. The classical Obstetric concept is caecum and appendix are pushed upwards due to the enlarged uterus. The pain in acute appendicitis is usually in the right iliac fossa only. Acute appendicitis in pregnancy can occur in 1in 500 – 2000 pregnancies. The estimated fetal loss is 3-5% and it can be even upto 20%, if perforation occurs.

Differential diagnosis:

Children:

In children the differential diagnoses are

1) Acute gastroenteritis
2) Mesenteric lymphadenitis
3) Meckels diverticulum
4) Henoch schonlein purpura
5) Lobar pneumonia

Acute gastroenteritis:

In acute gastroenteritis there will be pain and diarrhoea. It may mimic acute appendicitis. There will be fever and dehydration.

Mesenteric lymphadenitis:

In mesenteric lymphadenitis, pain is also present in right illiac

fossa. Pain is usually colicky in nature. Cervical lymphnodes may be enlarged in it. In meckels due to the presence of ectopic gastric mucosa, there may be frequent abdominal pain as intraluminal gastrointestinal bleeding.

Intussusception:

Intussusception is much more common than acute appendicitis in children. The age of presentation will be usually around 18 months. The presentation of intussusception will be red currant jelly stools. The management of it will be enema or open reduction.

Henoch schnolein purpura:

It is usually preceded by sore throat or respiratory tract infection. There will be echymotic lesion in the extensor surface of the buttocks. Microscopic hematuria with normal bleeding count is the common presentation.

Lobar pneumonia:

Right sided abdominal pain due to right lower lobe pneumonia and pleurisy may mimic acute appendicitis. In pneumonia, abdominal symptoms and signs will be minimal. Respiratory system examination will reveal pleural friction rub or altered breath sounds on auscultation.

IN ADULTS:

1) Terminal ileitis
2) Ureteric colic
3) Rt sided pyelonephritis
4) Perforative peritonitis
5) Terminal ileitis
6) Rectus sheath haematoma

Terminal ileitis:

Terminal ileitis may be due to

1) Non specific
2) Specific

In specific type it may be due to the Chrons and Yersinia. A chronic history of abdominal pain, weight loss, diarrhoea suggests regional ileitis rather than acute appendicitis.

Yersinia enteroclitica can cause ileitis and it can cause inflammation of caecum and appendix and mesenteric lymphadenopathy.

If mesenteric lymphadenopathy was there, node was divided into two, one was sent for histopathological examination and other was sent for culture.

Ureteric colic:

Pain due to ureteric calculus will be radiating from right loin to groin. Pain will be colicky type of pain. Routine urine examination should be done. Urine should be examined for red cells, pus cells, deposits, and albumibn. X ray KUB may reveal renal stone or ureteric stone. Renal USG or Intravenous urogram is usually diagnostic.

Right pyelonephritis:

Right sided pyelonephritis, pain occurs in right loin and also in right iliac fossa Patient will have high grade fever and associated co morbidities like diabetes. USG abdomen is the investigation of choice. CT abdomen can also be used to differentiate the pyelonephritis and acute appendicitis.

Perforated peptic ulcer:

If there is a duodenal perforation, the contents of perforation passes on to the paracolic gutter and then to the right iliac fossa. If the perforation got sealed , there will be collection in the right iliac fossa which will lead to pain, tenderness in the right iliac fossa. Since it is initially a duodenal perforation there will be previous history of abdominal pain in the epigastric region. There will be usually findings of free air under the diaphragm in plain X ray abdomen erect AP view.

Testicular torsion:

Testicular torsion is an important differential diagnosis in the acute appendicitis. Since the patients are usually of young age, they may have shyness to reveal the testicular pain. In such a situation it is necessary to examine the external genitalia, which is tender on palpation.

Acute pancreatitis:

Acute pancreatitis is also an important differential diagnosis in adults. In acute pancreatitis pain will be more on the epigastric region, may radiate to back, but it can be confirmed by serum amylase or lipase. CT is the investigation of choice for acute pancreatitis

Rectus sheath hematoma:

It is a rare differential diagnosis. The presentation may resemble that of acute appendicitis but it usually follows an episode of strenuous physical exercise. The gastrointestinal discomfort is usually absent in rectus sheath hematoma.

On those people who are on anticoagulants, rectus sheath hematoma may appear as mass in the right iliac fossa after trivial injuy.

Adult female:

In reproductive age group, the females can have gynaecological diseases like pelvic inflammatory disease, torsion or haemorrhage or rupture of ovarian cyst and ectopic pregnancy. The common differential diagnoses are

1) Pelvic inflammatory disease
2) Mittelschmerz
3) Torsion / haemorrhage of ovarian cyst
4) Ectopic pregnancy- ruptured or unruptured.

Pelvic inflammatory disease:

It includes a group of diseases like

1) Salphingtis
2) Endometriosis and
3) Tubo ovarian sepsis

These disorders are commoner in reproductive age group. Patient may give a history of discharge per vagina, dysmenorrhea, and burning micturition.

On examination the patient, may have adnexal and cervical tenderness. If pelvic inflammatory disease is suspected a high vaginal swab should be taken for Chlamydia trachomatis and Neisseria gonorrhoeae. Trans vaginal ultrasound can be done. If still there is a dilemma in the diagnosis diagnostic laparoscopy should be done. Oral

antibiotics like metronidazole and ofloxacin for 14 days is the drug of choice.

Mittelschmerz:

Rupture of ovarian follicle during mid cycle in the menstrual period produces abdominal pain which may mimic appendicitis. Systemic symptoms like fever may be absent.

Urine pregnancy test will be negative. If still there is a doubt in the diagnosis of acute appendicitis, diagnostic laparoscopy may be needed. There is an entity called retrograde menstruation which may mimic like that of acute appendicitis.

Ectopic pregnancy:

Unruptured tubal pregnancy can mimic that of acute appendicitis. Ruptured ectopic pregnancy with haemoperitoneum is unlikely to be like that of acute appendicitis with perforation

- Tubal pregnancy,
- Tubal abortion,

Can mimic exactly that of acute appendicitis.

In such situation the urine pregnancy test will be positive and a history of period of ammenorhea. Severe pain will be felt in the cervix on vaginal examination

Patient should be asked for any pain in the right iliac fossa which is radiating to the shoulder to rule out internal bleeding.

Elderly:

In elderly people, the following are the differential diagnosis

1) Diverticulitis
2) Intestinal obstruction
3) Carcinoma caecum

In patients with long sigmoid loop, the colon may come and lie in the right iliac fossa and diverticulitis of sigmoid colon may misdiagnosed as acute appendicitis. The investigation of choice to differentiate the diverticulitis and appendicitis is CT abdomen. If such a condition is suspected conservative management with iv antibiotics and iv fluids should be considered. Right colon diverticulitis is a rare entity and it is difficult to distinguish between the diverticulitis and acute appendicitis. If diverticulitis is the diagnosis, it should be treated conservatively and if it fails laparoscopy or laparotomy can be considered.

Intestinal obstruction:

Only in elderly acute appendicitis and intestinal obstruction are considered as differential diagnosis. If the diagnosis of intestinal obstruction is made, it has to be managed conservatively followed by surgery at appropriate time.

Carcinoma caecum:

A perforation of caecum due to malignancy of caecum mimics exactly that of perforated appendicitis.

History of altered bowel habits,

unexplained anaemia,

may raise the suspicion of carcinoma caecum.

On examination a mass may be palpable. The investigation of choice for carcinoma caecum is CT abdomen.

Rare differential diagnosis:

1) Preherpetic pain
2) Tabetic crisis
3) Spinal condition
4) Porphyria
5) Diabetic ketoacidosis
6) Typhlitis
7) Leukemic illeocaecal syndrome
8) Clostridial septecemia

Preherpetic pain:

Herpes involving the d10 and d11 spinal nerves can cause severe pain in the right iliac fossa. The pain in herpes will be severe and static not as in appendicitis where it is migratory in nature. Heretic eruptions can occur 3-8 hours after pain.

Tabetic crisis:

In tabetic crisis severe abdominal pain and vomiting can occur. Additionally other symptoms and signs of tabes can occur.

Spinal conditions:

Spinal conditions causing abdominal pain that mimics that of acute appendicitis can

Occur in childrens and elderly namely

- Tubercolosis of spine,
- Multiple myeloma,
- Metastatic deposits,
- Osteoporotic lesions,

All the above conditions can cause compression of nerve roots leading on to pain. Usually in the above said conditions gastrointestinal symptoms like vomiting and anorexia will be absent.

Porphyria:

Acute intermittent porphyria is an acute abdominal emergency. Abdominal pain can mimic that of acute appendicitis. It is a rare differential diagnosis in the children. There will be usually similar history of abdominal pain in porphyria.

Diabetic ketoacidosis:

In diabetic ketoacidosis there will be severe pain in the abdomen. In diabetic ketoacidosis the patient will be diabetic and plasma acetone will be positive.

Usually diabetic ketoacidosis is common in insulin dependent diabetes mellitus thereby it is commoner in childrens.

Typhilitis:

Initially the cause for acute appendicitis was thought to be due to thyphoid. Thyllitis is still the differential diagnosis for acute appendicitis.

Leukemic syndrome:

It is a rare and a potentially life threatening condition.

Clostridial septecemia:

Clostridial septecemia is a rare progressively fatal condition. Treatment is with appropriate antibiotics. Surgical intervention is rarely needed.

Appendicitis in pregnancy, the risk is similar to that of non pregnant woman of the same age. Appendicitis occurs more frequently during the first two trimesters, and during this time period the symptoms of appendicitis are similar to those seen in non pregnant women. During the third trimester, the cecum and appendix are displaced upwards. This results in localization of pain either more cephalad or laterally in the flank, leading to delay in diagnosis and an increased incidence of perforation and diffuse peritonitis as displacement of the omentum by the uterus impairs localization of the inflamed appendix. It is the peritonitis, and not the appendectomy, that poses the risk to the mother and fetus alike, and therefore, early operation is the rule.

Nothing can be so easy or as difficult as the diagnosis of acute appendicitis.The clinical examination and the investigations are non-specific. Thus, the list of differential diagnosis is long.[24-28.] Some of the entities in the differential diagnosis of appendicitis also require operative therapy and are not made worse by an exploratory laparotomy, but it is necessary to eliminate pancreatitis, myocardial infarcation, and basal pneumonia for which surgery would be a blunder. The disease in young children that are most frequently mistaken for acute appendicitis are gastroenteritis, mesenteric lymphadenitis, meckels's diverticulitis,

pyelitis, small intestinal intussusception,enteric duplication, and basilar pneumonia. In teenagers and adults, the differential diagnosis is different in men and women. In young women, the differential diagnosis include ruptured ectopic pregnancy, mittelschmertz, endometriosis, ureteric colic and salpingitis. Chronic constipation also needs a considerationIn older patients, the differential diagnosis include diverticulitis, a perforated peptic ulcer, acute cholecystitis, acute pancreatitis, intestinal obstruction, perforated caecal carcinoma, mesenteric vascular occlusion, rupturing aortic aneurysm, and the disease entities already mentioned for young adults.

DIAGNOSTIC STUDIES

Routine history and physical examination remain the most practical diagnosis modalities. No laboratory or radiological test yet devised is diagnostic of this condition.

White cell count:

The polymorpholeucocytosis is an important feature of acute appendicitis. In three quarters of patients the white cell count is raised above 12,000/cmm.[4]However, in others, the count may be slightly raised or normal, especially in children.[38]Neutrophilia is also one of the features of appendicitis. In 1982,Pieper et al[40]noted that 66.7% had white cell count of 11,000/cmm or more and in only 5.5% it was raised above 20,000/cmm. Anderson et al[39] reported that the WBC and neutrophils count had higher power in discriminating for advanced appendicitis than for all appendicitis. Appendicitis was unlikely at lowest level of the WBC and neutrophils count and rate (LR0.16-0.28 at WBC count <8000/cmm, neutrophils count <7000/cmm, or rate<70%) and likely at the highest WBC Count. Neutrophils count >13,000/cumm and rate >85%. However, Coleman C et al reported that WBC is a poor predictor of the severity of the disease in the diagnosis of acute appendicitis.[41]

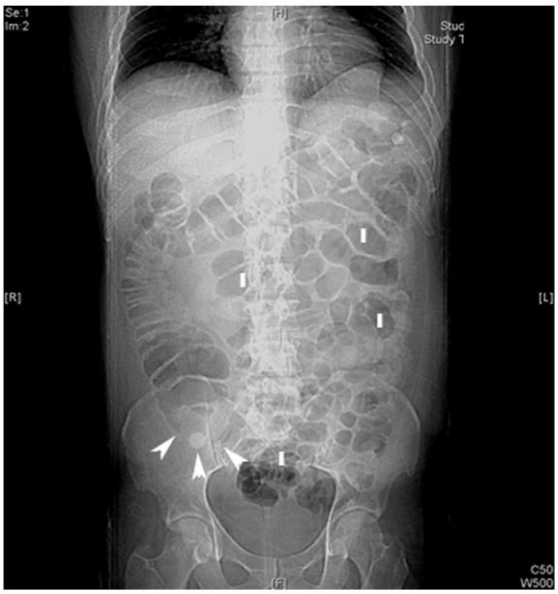
Urine examination:

The presence of hematuria or pus cells in the urine does not rule out appendicitis. Irritation of ureter or urinary bladder by the inflamed appendix may cause microscopic hematuria or pyuria.[24-26]Graham(1965) quantitatively analysed midstream urine specimens in 71 patients operated upon with the diagnosis of acute appendicitis. Of these, 62 had an acutely inflamed appendix removed and nine patients had normal appendix. In this whole group, nine female patients had microscopic pyuria and one also had hematuria. One male patient had microscopic hematuria.[26]

C-reactive protein

CRP is a non specific acute phase reactant, which appears in the sera of individuals in response to a variety of inflammatory conditions and tissue necrosis. It is a non-specific indicator for acute appendicitis. There have been various studies regarding the importance of CRP in differentiating appendicitis from other non inflammatory conditions of the abdomen.[11]One of the such studies showed that CRP value is increased markedly only after appendiceal perforation or abscess formation.[10]However increase in leukocyte count was found to be an

XRAY PICTURES



early marker of appendiceal inflammation. This study reported that the CRP concentration and temperature had high power in discrimating advanced appendicitis than all appendicitis. Also the CRP concentration >10mg/L was found to be one of the independent predictors of appendicitis.[39]

Radiography:

Plain films of abdomen in supine and erect position are of value in differential diagnosis of acute abdominal pain. However, they are non specific. Brookes and Killen[42]have described a number of radiological signs in patients with acute appendicitis:

- Fluid level localized to the caecum and to the terminal ileum
- Localized ileus, with gas in the caecum, ascending colon or terminal ileum
- Increased soft tissue density in the right lower quadrant.
- Blurring of right flank stripe, the radiolucent line produced by fat between the peritoneum and transverse abdominals.
- A faecolith in the right iliac fossa
- Blurring of psoas shadow on the right side

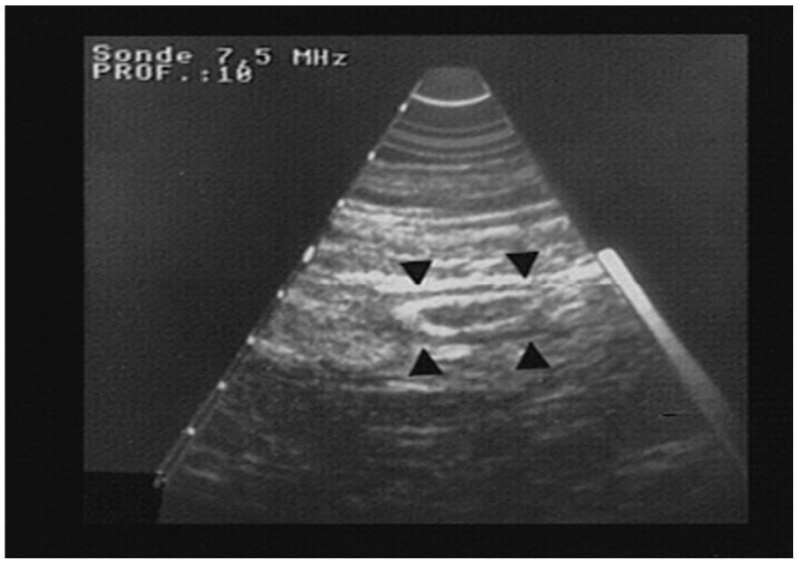
- A gas filled appendix
- Free peritoneal gas
- Deformity of caecal gas shadow due to an adjacent inflammatory mass They reviewed the x-rays of 200 patients underwent laparotomy for acute appendicitis without knowing the diagnosis. 80% of patients with acute appendicitis had one or more of these signs positive. However 37% of patients who had normal appendix had similar x-ray findings. Thus, plain films of abdomen are neither sensitive or specific to alter the maxim "If the diagnosis of appendicitis remains in doubt ,still appendicectomy is the accepted treatment ".[43]

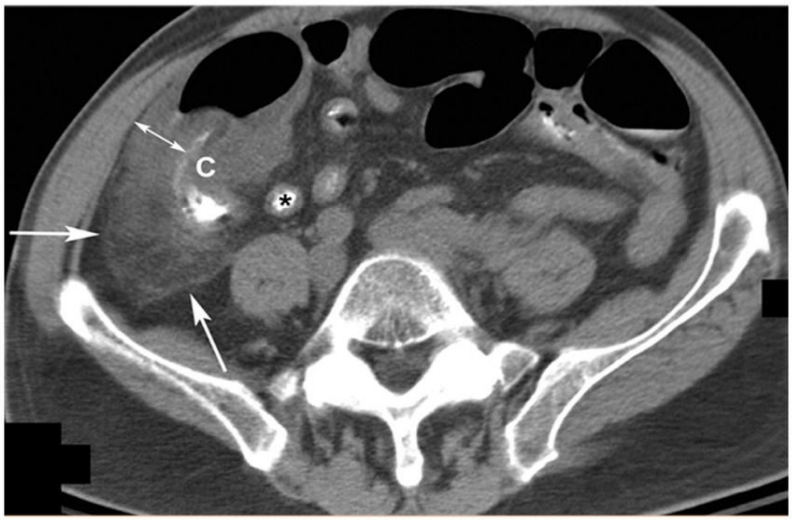
Ultrasonography :

In 1989, Julien B.C.M. Puylaert described the value of graded compression sonography in the evaluation of acute appendicitis. The accuracy afforded by sonography should keep negative laparotomy rates at approximately 10%, clearly an improvement over the rate achieved by instinct alone. Ultrasound proved most useful for those patients who have an indeterminate probability to the disease upon initial clinical examination. The sonographic hallmark of appendicitis is direct visualization of the inflamed appendix. The typical appearance is that of a concentrically layered, almost incompressible, sausage like structure demonstrated as the site of maximum tenderness.

The usual findings are:

- Visualization of noncompressible appendix as a blind-ending tubular aperistaltic structure in the right iliac fossa.
- Target appearance of >6mm in total diameter on cross section (81%)maximal mural wall thickness >2mm.
- Diffuse hypoechogenecity (associated with higher incidence of perforation)
- Lumen maybe distended with anechoic/hyperechoic material.
- Loss of wall layers
- Visualization of appendicolith (6%)
- Localised periappendiceal fluid collection
- Prominent hyperechoicmesoappendix/pericaecal fat.





USG AND CT

Colour Doppler findings are:

- Increased conspicuity (increase in size & number) of vessels in and around the appendix (hyperemia)
- Decreased resistance in arterial waveforms
- Continuous/pulsatile venous flow

The most important reason for a false negative ultrasound examination is overl ooking the inflamed appendix. In experienced hands the inflamed appendix can be visualized in 90% of patients with non-perforated appendicitis, 85% of those with an appendiceal mass and in 55% of those with free perforation of the appendix. Peritonism preventing graded compression probably accounts for the limited success in patients with appendiceal perforation. In addition air filled dilated bowel loopsfrom adynamic ileus may hide the appendix from view.

Computed Tomography:

Abdominal CT has become the most important imaging study in the evaluation of patients with atypical presentations of appendicitis. Studies have shown a decrease in negative laparotomy rate and

appendiceal perforation rate when abdominal CT is used in selected patients with suspected appendicitis.

Advantages of CT scanning include its superior sensitivity and accuracy compared with those of other imaging techniques, ready availability, non invasiveness, and potential to reveal alternative diagnoses.

Disadvantages include radiation exposure, potential for anaphylactic reaction if intravenous (IV) contrast agent is used, lengthy acquisition time if oral contrast is used, and patient discomfort if rectal contrast is used.

Initial studies evaluated sequential (nonhelical) CT in the diagnosis of appendicitis. In 1993, Malone evaluated non enhanced, sequential CT in 211 patients and reported a sensitivity of 87% and a specificity of 97%. The addition of IV and oral contrast agent increases sensitivity to 96-98% but increases cost to approximately $900. Sequential CT with oral and IV contrast enhancement is highly accurate but time consuming and expensive; it is best used for equivocal presentations when helical CT is not available.

In 1997, Lane evaluated helical CT without contrast enhancement and found a sensitivity of 90% and specificity of 97%. More recent studies of non contrast helical CT in adults with suspected appendicitis showed a sensitivity of 93-96% and a specificity of 92-99% (Lane, 1999; Ege, 2002; Yuksekkaya2004).

In a 2004 study of pediatric patients, Kaiser found that nonenhanced CT was 66% sensitive. Sensitivity increased to 90% with the use of IV contrast material. In 1997, Rao found that focused (lower abdominal and upper pelvic) helicalCT with 3% Gastrografin instilled into the colon (without IV contrast agent) had a superior sensitivity of 98% and specificity of 98%. Focused helical scanning without IV contrast agent eliminates the risk of anaphylaxis and reduces the cost to about $230. Acquisition time is <15 minutes.

Radiation exposure is less than that of a standard obstruction series. Alternative diagnoses are revealed in up to 62% of patients and include diverticulitis, nephrolithiasis, adnexal pathology, RLQ tumor, small-bowel hernias, and ischemia.

The current literature suggests that limited helical CT with rectal contrast enhancement is a highly accurate, time-efficient, cost-effective way to evaluate adults with equivocal presentations for appendicitis. Two studies of focused helical CT in children suggest a sensitivity of 95-97%. Continued improvements in helical CT technology and image interpretation may allow non enhanced helical CT to be the imaging test of choice in the future.[17]

Scoring System

In order to reduce the negative appendectomy rates various scoring systems have been developed for supporting the diagnosis of acute appendicitis.[2,45]Initial evaluation studies have shown excellent results, indicating that scoring systems would be ideal as diagnostic aids because they have good performance and require no special equipment, being user friendly and comprehensible to the clinician. One such scoring system was Alvarado score that was based on sophisticated statistical analysis of symptoms, signs and laboratory data on 305 patients admitted to Nazareth Hospital in Philadelphia from 1975 to 1976. Studies have shown that Alvarado score has diagnostic accuracy of around 88%

Interpretation of the Alvarado score

Characteristic	**Score**
M = migration of pain to the RLQ	1
A = anorexia	1
N = nausea and vomiting	1
T = tenderness in RLQ	2
R = rebound pain	1
E = elevated temperature	1
L = leukocytosis	2
S = shift of WBC to the left	1
Total	10

Score 1-4: Acute Appendicities very unlikely, keep for observation

Score 5-6: Acute Appendicitis maybe, regular observation.

Score7-10: Acute Appendicitis probable, operate

CLINICAL OUTCOME FOR APPENDICITIS

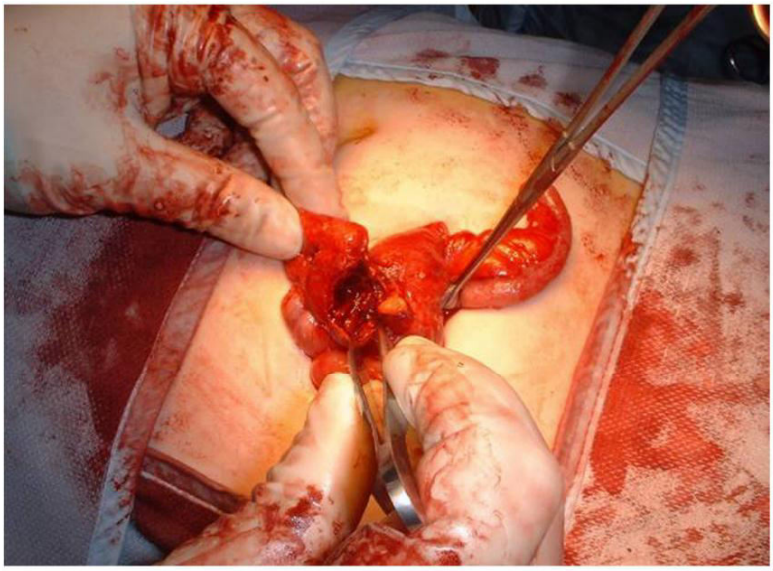
1. Resolution
2. Gangrenous appendicitis
3. Perforation leading to generalized peritonitis
4. Appendicular mass or abscess formation
5. Fibrosis

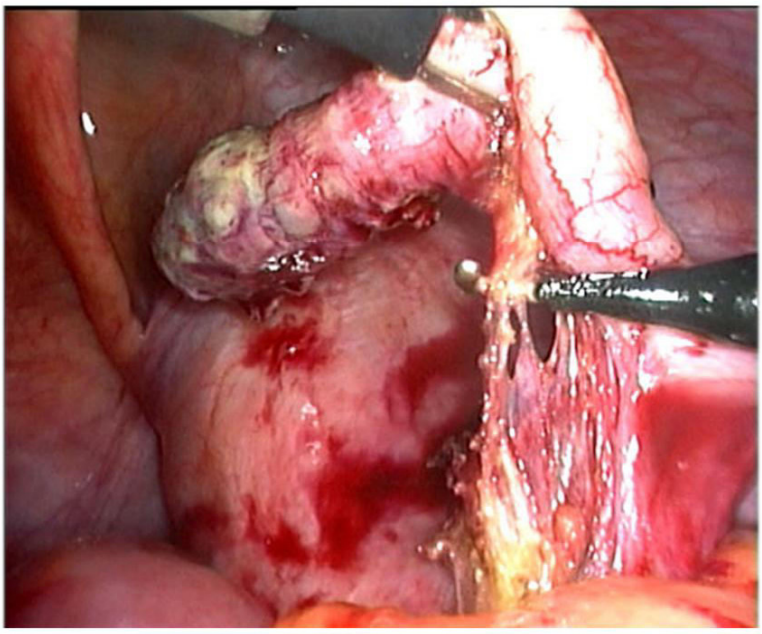
TREATMENT:

There are two types of presentation for acute appendicitis, one is obstructive and the other is non obstructive. For a non obstructive appendicitis there is an emerging concept of conservative management. For obstructive type the treatment of choice is open or laparoscopic appendicectomy. For conservative management, the common drugs used are third generation cephalosporins and metronidazole. By conservative management in less severe appendicitis, the success rate was around 90%. In older age group the underlying malignancy has to be considered.

If the patient is presenting in the emergency department with acute appendicitis with impending rupture, emergency appendicectomy is indicated. Emergency appendicetomy is needed in such cases to reduce the morbidity and mortality associated with it. Initially patient should be stabilised with intravenous fluids to obtain adequate hourly urine output. If

there are signs of peritonitis, intravenous antibiotics are needed. The antibiotics should cover both anaerobic cocci and gram negative bacilli. If there is hyperpyrexia it has to be treated with antipyretics. After all the initial resuscitative measures the patient should be taken up for emergency appendicectomy.





Open and Laparoscopic Appendicectomy

Open appendocectomy:

Anaesthesia: General anaesthesia/ Spinal anaesthesia/Epidural anaesthesia

Position: supine

Incisions:

1) Grid iron incision
2) Lanz incision
3) Rocker Davis incision
4) Fowler Weis extension
5) Rutherford Morrison extension

Grid iron incision:

Incision is perpendicular to the line joining the anterior superior iliac spine and the umbilicus. The centre of the incision lies at the Mc Burneys point

Lanz incision:

Transverse skin crease incision of length 3cm made just 2cm below the umbilicus with its centre at the mid inguinal point.

Rt paramedian or Rt pararectal incision:

Such incisions are used when there is a doubt in the diagnosis of acute appendicitis. It is usually made when diagnosis other than acute appendicitis is suspected.

In this incision, the exposure will be adequate to perform resection anastomosis if there is gangrenous bowel segment.

Rutherford Morrison incision:

It is a muscle cutting incision. It is made similar to that of grid iron incision with an oblique lateral extension.

This incision is especially useful in retrocaecal as well as subhepatic in position or if the appendix is adherent to the surrounding structures.

Removal of appendix:

Caecum should be identified in the right iliac fossa. It is usually identified by the tinea coli.

Since there is inflammation in acute appendicitis the adhesions due to the inflammation is freed by the fingers. The base of the appendix is usually identified at the confluence of the taenia coli.

The appendix has to be grasped by babcocks and then it was taken out. The mesoappendix is clamped, ligated, and then divided. If the entire mesoappendix is ligated and divided, the base of the appendix became free. The base of the appendix is crushed with artery forceps. An absorbable 2-0 vicryl is used to transfix the base of the appendix. Then the

base of the appendix was amputated at 2.5cm from the base.

Special circumstances:

If there is excessive inflammation and the caecal wall is oedematous, invagination of the base of the appendix should not be attempted.

If the base of the appendix is gangrenous, through and through sutures through the caecal wall should be taken, and the gangrenous appendix should be removed close to the caecal wall and the sutures taken in the caecal wall should be tied. Second layer of seromuscular suture is done using 2-0 silk.

Retrograde appendicectomy:

If the appendix is retrocaecal, it is difficult to identify the tip of the appendix. The base of the appendix is identified, ligated and divided followed by ligation and division of the mesoappendix to the tip.

Laparoscopic appendicectomy:

Pre operative preparation:

1) adequate hydration
2) pre operative antibiotics
3) nasogastric tube
4) bladder catheterisation

Position: Position is supine.

Anaesthesia: General anaesthesia.

Port position:

1) 10 mm or 12mm port sub umbilical
2) 5mm port in suprapubic region
3) 5mm port in left iliac fossa lateral to rectus sheath

Pneumoperitoneum is created by

1) Open Hassan technique
2) Veress needle
3) Optical view trocar

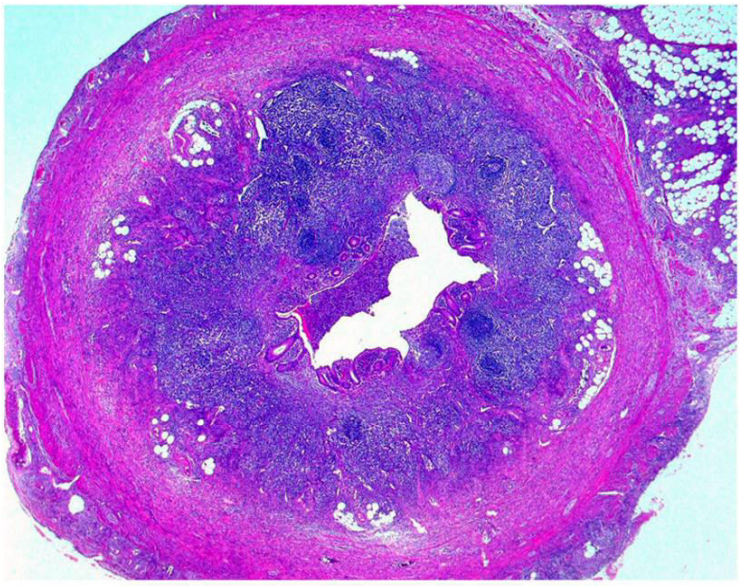
After creating pnemoperitoneum, 10mm port is placed and then telescope is introduced through the 10mm port. Two 5mm ports are placed at suprapubic and left lower quadrant of the abdomen.

First, the entire abdomen is visualised using the telescope. Then the bowel loops in the right iliac fossa are taken out. Then the caecum is identified. The the appendix is identified at the confluence of the taenia coli. In laparoscopy the appendix is usually easily visible. If the appendix is retrocaecal in position, then mobilisation of the caecum is needed.

Once the appendix is identified, it is then grasped using grasper and the mesoappendix is cauterised and the base of the appendix is freed from the mesoappendix. Sometimes the appendicular artery can be ligated using clips or a 2.5mm linear stapler can be used to divide the mesoappendix.
Two sutures were applied at the base of the appendix. The base is then amputated above the second knot. The removed appendix is taken out using a bag. Then the base is looked for any bleeding. Pneumoperitoneum was evacuated and then the wound is closed in layers.

Problems encountered during appendicectomy

1) A normal appendix is found
2) Appendix could not be traced
3) Appendicular tumour is found
4) Appendicular abscess/mass



HISTO PATHOLOGY OF INFLAMMED APPENDIX

A normal appendix is found:

If normal looking appendix is found, then one has to search for the cause of pain in the right iliac fossa. Even though the appendix looks normal , routine appendicectomy has to be done to rule out the cause. A normal looking appendix may show microscopic evidence of inflammation and hence it is always prudent to do appendicectomy.

Appendix could not be traced:

If appendix could not be visualised, mobilisation of caecum from the posterior abdominal wall attachment is needed. The confluence of the taenia coli is noted to identify the base of the appendix. If still appendix is not found, then it is considered to be absent.

Appendicular tumour is found:

If appendicular tumour is found preoperatively one has to see the size of the tumour

If the size of the tumour is less than 2cm, then appendicectomy alone is enough.

If the size of the tumour is more than 2cm, then the treatment of choice is right hemicolectomy.

Management of appendicular abscess:

If a well defined inflammatory mass is formed then conservative management is considered. The conservative management is called as **Ochsner Sherren regimen**. While managing the appendicular mass, it is necessary to observe the patient closely. Usually the patient will improve in 24-48 hours. Any increase in temperature, pulse rate, and size of the mass, the conservative management should be abandoned. Even if the patient is not improving carcinoma colon and chrons disease has to be considered. If the patient is elderly colonoscopy has to be done to rule out appendicular or colonic malignancy as there is 5% chance for the patients to harbour malignancy.

Chron's disease with appendicitis:

Rarely intra operatively patient may found to have associated Chrons disease in the illeocaecal region. If the caecal wall is healthy then appendicectomy can be done. If the appendix is also found to get involved then corticosteroids and intravenous antibiotics has to be used to treat the acute condition.

Post operative complications:

1) Surgical site infection
2) Intraabdominal abscess
3) Ileus
4) Respiratoy tract infection
5) Deep vein thrombosis
6) Portal pyemia
7) Faecal fistula
8) Adhesive intestinal obstruction

Surgical site infection:

Surgical site infection is one of the common complications of appendicectomy. It occurs in around 10% of patients. Local examination of the wound reveals warmth, tenderness, purulent discharge. Treatment is drainage of pus, wound dressing and antibiotics. Since the surgery is on GIT the organisms responsible for it gram negative bacilli and Bacteroides species.

Intra abdominal abscess:

Intra abdomianl abscess is another known complication of acute appendicitis. It occurs in around 8% of the persons undergoing appendicectomy. It is nowadays reduced due to the use of modern antibiotics. Patients usually presents with fever, vomiting, and anorexia

after 5-7 days of surgery. Ultra sonogram is the investigation of choice which can locate the site of intra abdominal abscess. Image guided percutaneous aspiration is done. If it fails laparotomy has to be done.

Ileus:

Following appendicectomy for gangrenous appendicitis a period of ileus can occur. Usually it will settle in 4-5 days. If the ileus persists for more than 5 days, it usually indicates an intra abdominal sepsis. It intra abdominal sepsis persist it warrants emergency surgical intervention. Rare type of hernia called as richter type of hernia can occur and it may cause ileus and CT abdomen is needed for the diagnosis.

Respiratory:

Usually respiratory tract infection similar to that of other intra abdominal surgeries will not occur following appendicectomy. If patient is already having any respiratory illness it can precipitate it. Antibiotics and chest physiotheraphy is given to prevent the condition.

Deep vein thrombosis:

Deep vein thrombosis is rare following appendicectomy. If an elderly female who is on oral contraceptive pills can develop deep vein thrombosis. In such cases appropriate prophylactic measures should be taken.

Portal pyemia:

It is one of the rare complication of acute appendicitis and it is a potentially life threatening complication of acute appendicitis. Patient

presents with high fever with rigor and jaundice. It will lead on to hepatic abscess. It is treated by systemic intravenous antibiotics. The hepatic abscesses are drained percutaneously.

Faecal fistula:

It is a complication of acute appendicitis. Faecal fistula can occur due to

1) Leak from the appendicular stump
2) From caecal wall due to inflammation of the caecum
3) Chrons disease complicating appendicitis

Conservative management is usually needed.

Adhesive intestinal obstruction:

It is a late complication following appendicectomy. Usually a band may present in right illiac fossa and usually can cause chronic abdominal pain. Laparoscopy is both diagnostic and therapeutic in this condition. Laparoscopic adhesiolysis is the procedure of choice.

MORTALITY

Sir Reginald Fitz in 1889 described appendicitis for the first time. The statistics of England and Wales showed that in 1938, there were more than 3000 deaths per year from appendicitis. By 1980, it had fallen to only 179. Grey Turner reported in1955 than on reviewing 2500 personal appendicectomies, he found that the mortality rate of 0.68% in cases with diffuse peritonitis. The overall mortality of the series was 3.5%26. Pieper et al in 1982 reported only 2 deaths in their review of 1018 appendicectomies(0.2%).[40]Mortality has decreased from 26% to less than 1% in the last hundred years.

METHODOLOGY

A prospective study was carried out from Janaury 2014 to September2014in the Department of General Surgery, Thanjavur Medical College, Thanjavur. India. The total period of study was 6 months. One hundred patients suspected of acute appendicitis were included in the study. Patients satisfying the inclusion and exclusion criteria were enrolled in the study.

Inclusion criteria: All patients presenting with right iliac fossa pain

Exclusion criteria:

- Pain > 5 days duration
- Appendicular lump/mass
- Features of Peritonitis
- Features of intestinal obstruction
- History of trauma to right iliac fossa
- Patients presenting with pain abdomen along with distension of abdomen
- Pregnant females
- Patient with previous history of any abdominal surgeries
- Patient not willing for surgery.

After initial evaluation of the patient in the casualty/opd of Thanjavur medical college hospital by senior residents of general surgery, patients with the diagnosis of acute appendicitis were admitted to the wards. The female patient had pelvic examination or gynaecological consultation if felt necessary.38

The detailed history, clinical examination, laboratory investigations were done which included routine Haematological investigations, Urine routine, X-Ray KUB and USG Abdomen and Pelvis. A specially designed proforma was filled in for each patient. These proforma had general information about the patient plus eight variables based on the Alvarado scoring system. Then the sum of all these scores were calculated for each patient and based on the results patients were divided into three groups.

Total score 7 – 10 (Group A): These patients were considered to have acute appendicitis and patients were prepared and emergency appendicectomy was done.

Total score 5 – 6 (Group B): These patients were considered to be equivocal and hence they are observed by conservative management. If the general condition and the symptoms of the patients were improved, means decrease in the total score; such patients were discharged with the advice to

return if the symptom recurs. If the patients developed severe pain and total score got increased then patients had to be taken up for surgery.

Total score 1 – 4 (Group C) These patients were considered to have either less severe appendicitis or some other. Such group of patients were managed symptomatically and then discharged. They were also advised to come if the symptoms recurs.

The diagnosis of acute appendicitis was confirmed by operative findings and histopathological assessment of the appendicectomy specimen with the ultimate criterion for the final diagnosis of acute appendicitis being the histological demonstration of polymorphonuclear leukocytes throughout the thickness of the appendix.

RESULTS

During the 6 month period from January 2014 to September 2014, a prospective study of the use of the Alvarado score was made on a consecutive series of 100 patients admitted to the Department of General Surgery, Thanjavur medical college hospital,Thanjavur, with clinical features suggestive of Acute Appendicitis. The results are as follows. In the present study, the minimum age was 10 years and the maximum age was 64 years.

The number of patients were highest in the age group 21-30(42%) years followed by 10-20(31%) years. The least was in the age group of 61 to 70(1%) . Out of the 100 patients, 59 were female (59%) and 41 were male (41%). The male to female ratio was 1:1.4. Mean age was 26.97years (range 10-70 years, 11.02 years standard deviation), with median age of 29 years. Most of the patients were of younger age group. This result shows that there is predominance in the younger age group and the incidence peaks around 10 to 30 and decreased as age progressed.

Table 1 Age and Sex Distribution.

Age	Male	Female	Total
10-20	13	18	31
21-30	21	21	42
31-40	4	13	17
41-50	2	5	7
51-60	0	2	2
61-70	1	0	1
TOTAL	41	59	100

Graph 1 Age and Sex distributuion

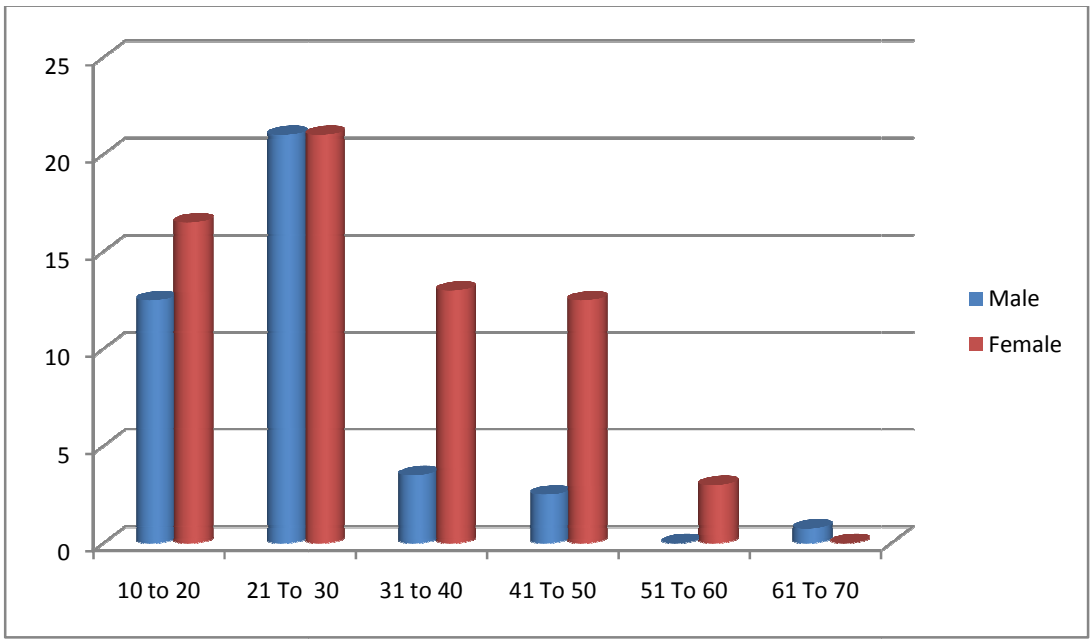


Table 2. Sex Distribution

Male	Female
41	59

Graph 2. Sex Distribution

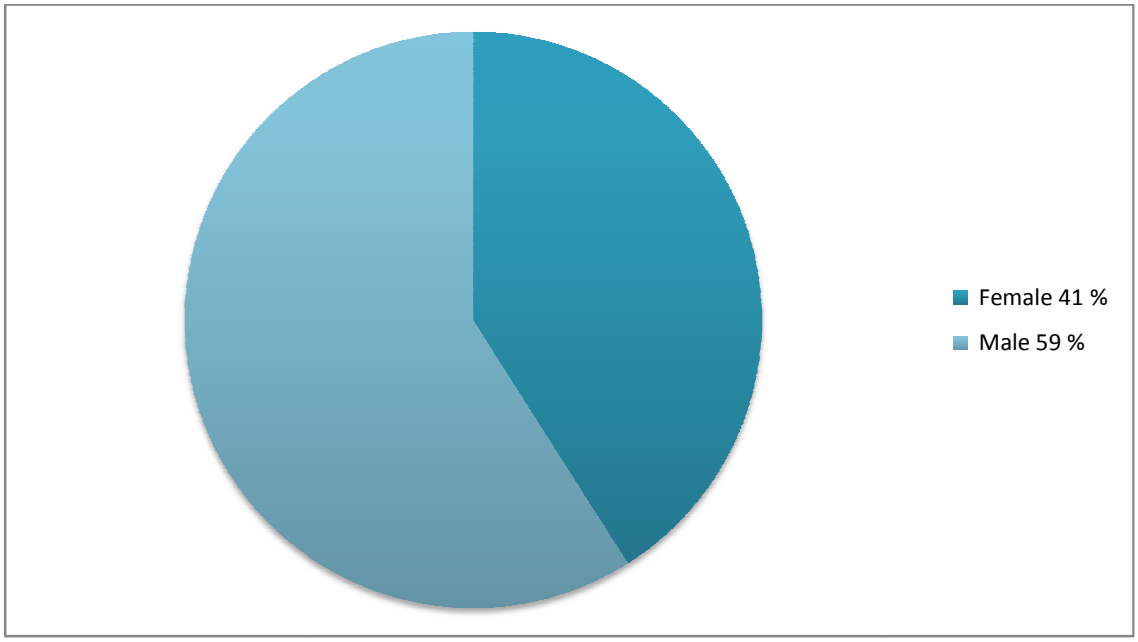
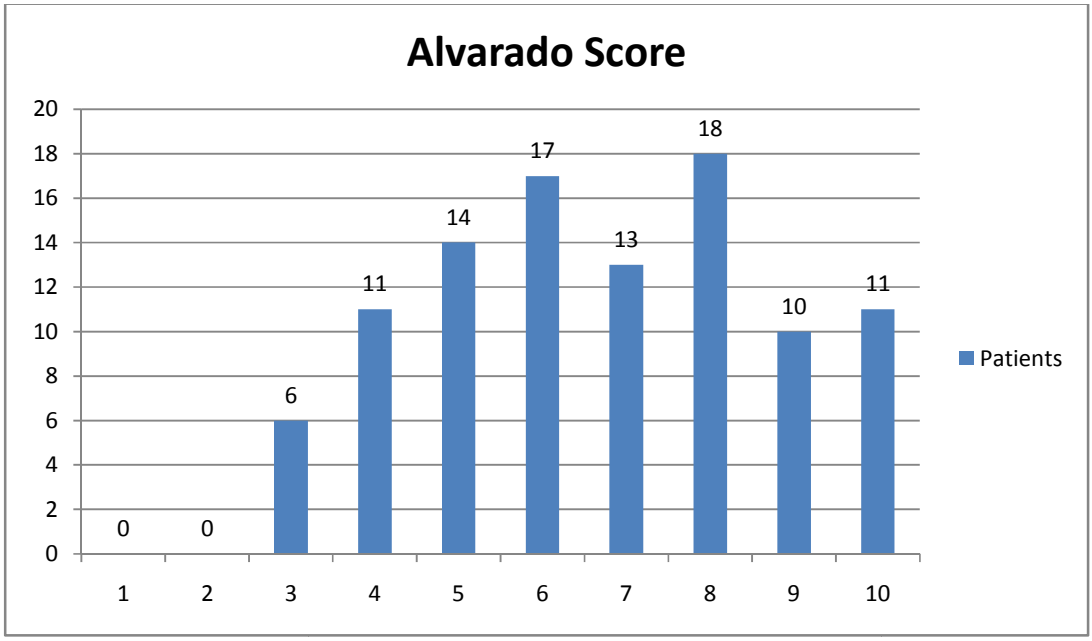


Table 3. Frequency distribution of patients according to Alvarado score

Score	No of patients (%)
1	-
2	-
3	6 (6%)
4	11 (11%)
5	17 (17%)
6	13 (13%)
7	13 (13%)
8	18(18%)
9	10(10%)
10	11(11%)

Graph 3.Frequency distribution of patients according to Alvarado



The results of application of Alvarado scoring system is given in table3. Mean for the emergency surgery group(group A), observation group(group B) and home group(group C) were 8.36, 5.55 and 3.65 respectively (range of score 1-10).

Table 4 Results of application of Alvarado score

Alvarado score	Male	Female	Results	Percentage
Group A	20	32	52	52
Group B	14	17	31	31
Group C	7	10	17	17

Graph 4 Results of application of Alvarado score

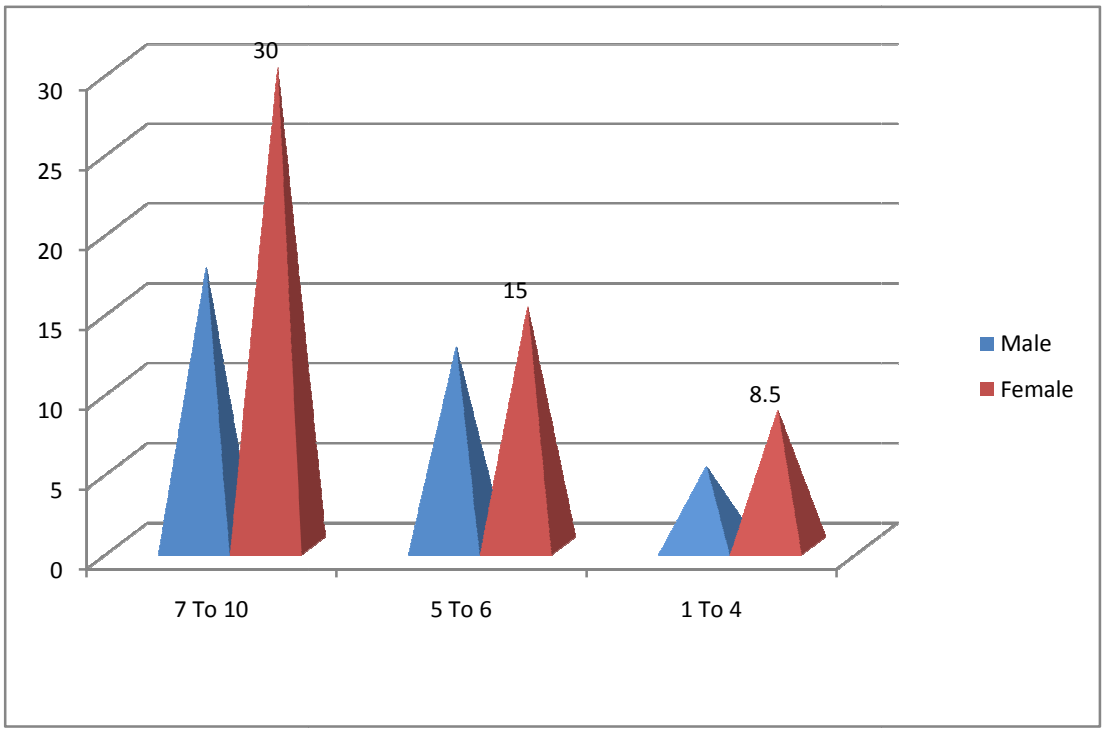


Table 5. Mean Scores of different groups

Group score	Mean
A	8.63
B	5.55
C	3.65

Graph 5. Mean Scores of different groups

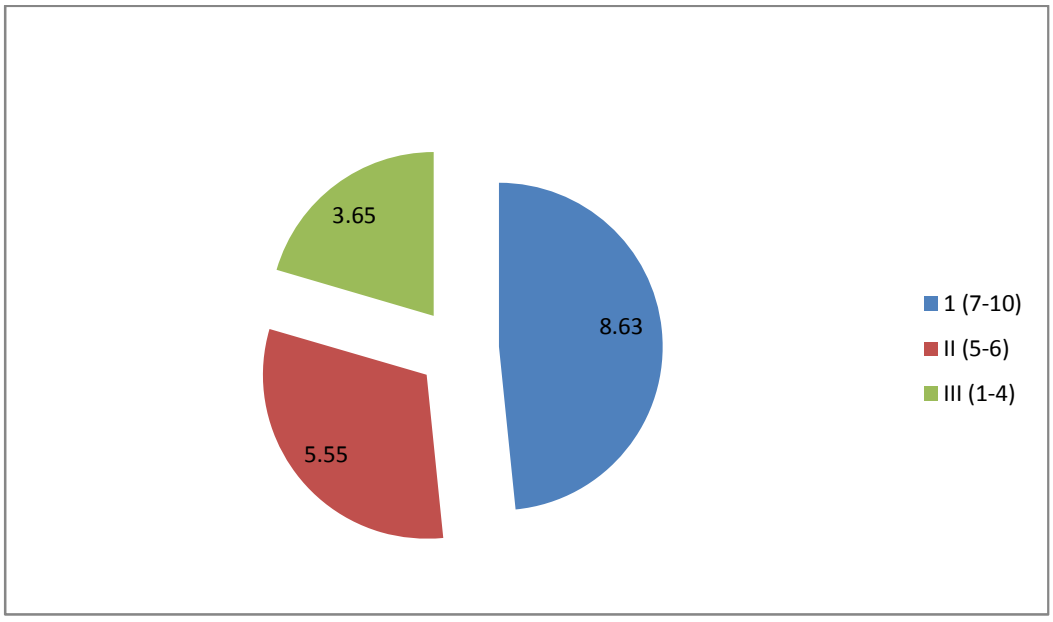
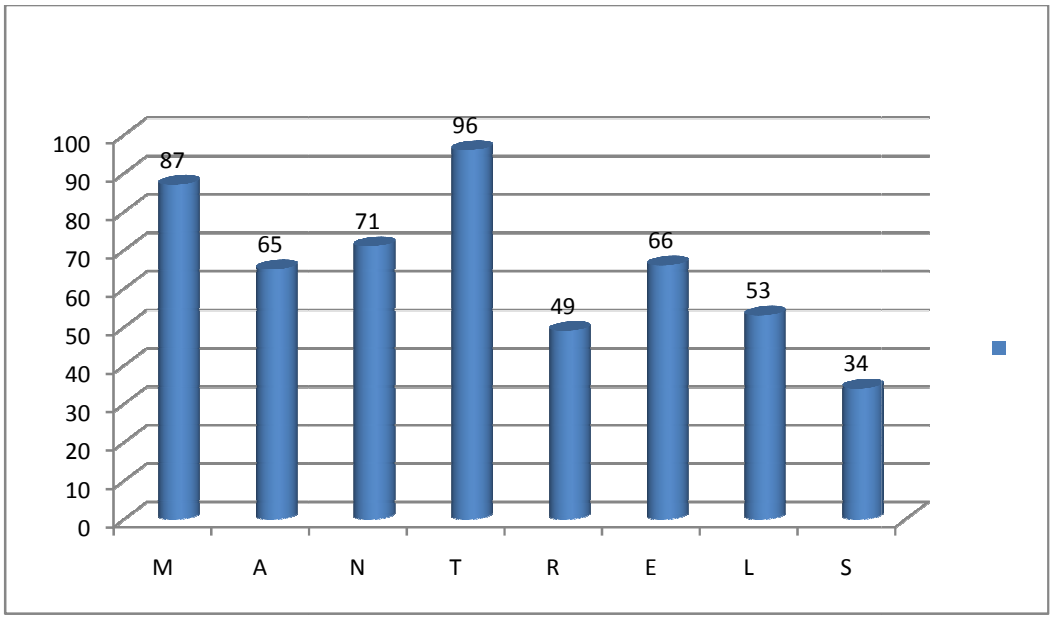


Table 6. Individual features of the Alvarado Score

Features	Score	Number	Percentage
M= migration of pain to RLQ	1	87	87
A= anorexia	1	65	65
N= nausea and vomiting	1	71	71
T= tenderness in RLQ	2	96	96
R = rebound pain	1	49	49
E= elevated temperature	1	66	66
L = leukocytosis	2	53	53
S= shift of WBC to the left	1	34	34

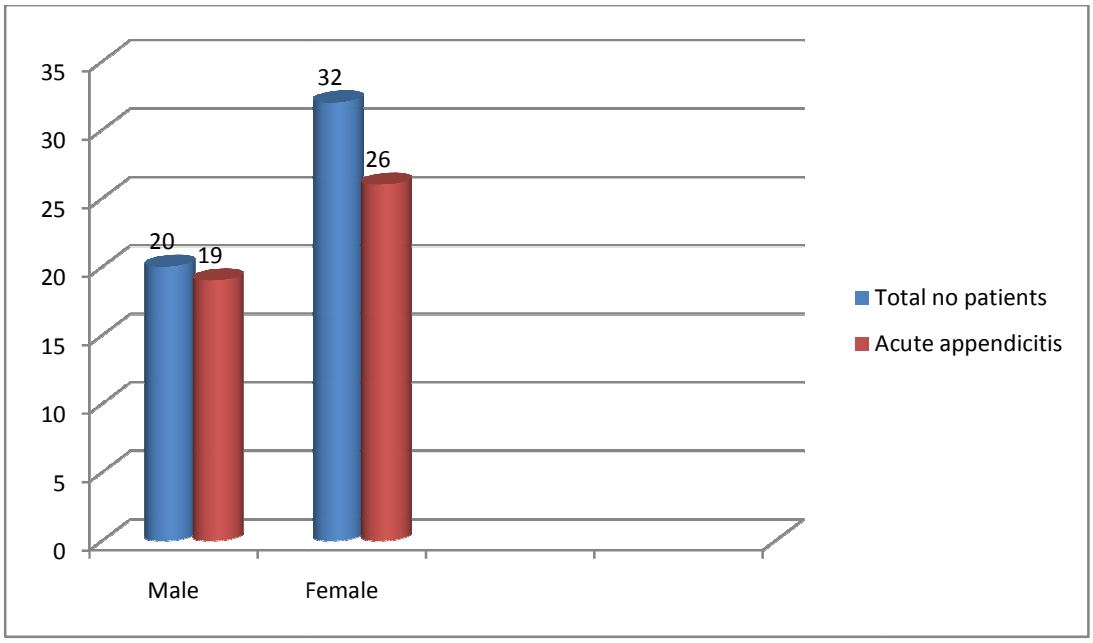
Graph 6. Individual features of the Alvarado Score



Group wise results were as follows. In 52 patients (52%) the score was found to be 7 or more. All were admitted and underwent appendicectomy. Among them 32 were female(61.5%) and 20 males (38.5%). Operative findings and histopathological reports showed 45 patients had inflamed appendix and 7 patients had normal appendix

Table 7. Results of GroupA

Sex	Total No of Patients	Acute Appendicitis
Male	20	19
Female	32	26
Total	52	33

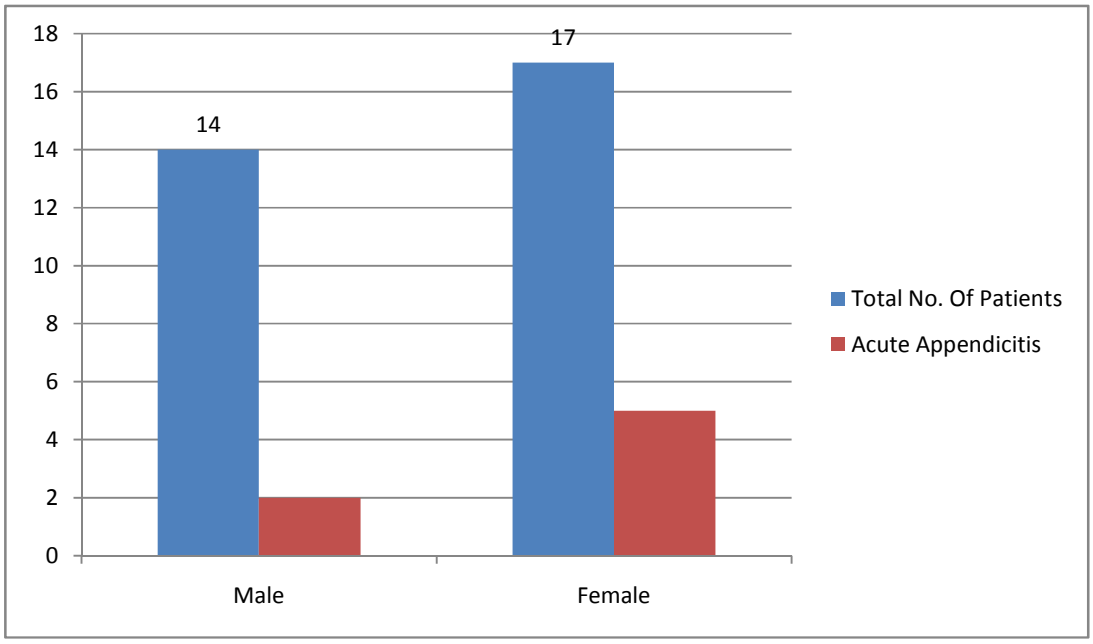


31 patients (31%) had a score of 5-6; all were admitted for observation and regular evaluation. This group comprised of 17 female (54.8%) and 14 male (45.2%) patients. 22 patients ended up in a score of 6 0r less after 24 hours and therefore were discharged. Only 9 patients had increased severity of symptoms with score 7 and more on re evaluation within the first 24 hours. These 9 patients underwent appendicectomy. Operative findings and histopathological reports showed that 7 ptients had inflamed appendix and the remaining 2 patients had normal appendix

Table 8. Results of Group B

Sex	Total no Patients	Acute appendicitis
Male	14	2
Female	17	5

Graph 8 Results of Group B

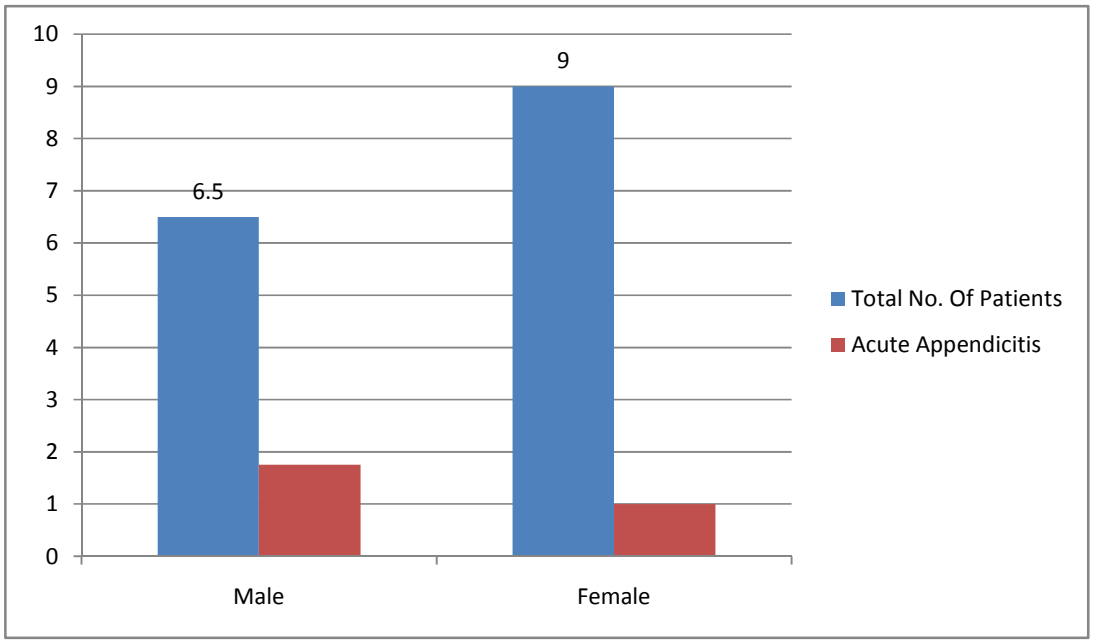


There were 17 patients (17%) with Alvarado score of 1-4. Among them 17 were female (58.8%) and 14 were male (41.2%). All of them were discharged after initial assessment and symptomatic treatment. 3 of them came back with increased severity of symptoms and score of 7 or more with in 48 hours. They were admitted and all of them underwent appendicectomy. Operative findings showed that all the 3 patients had inflamed appendix.

Table 9. Results of Group C

Sex	Total no. of Patients	Acute Appendicitis
Male	7	2
Female	10	1

Graph 9. Results of Group C



Total number of surgeries performed in this study was 64 (64%). Among these patients 39 were female and 25 were male. Operative findings and histopathological reports showed that 54 patients (84.4%) had inflamed appendix including 32 female patients and 22 male patients. Among all surgeries performed 5 patients (7.8%) had perforated appendices, 7 patients (10.9%) had gangrenous appendices and none of them were missed by Alvarado score and all were operated. Results of our operative exploration are shown in table The negative appendicectomy rate in our study was 15.62%.

The negative appendicectomy rates for males and females were 12% and 17.9% respectively.The sensitivity of Alvarado scoring system was 94.44% and the specificity was around 78.26%. The positive predictive value of the scoring system was 83.60% in our study with it being higher in males (males-86.95%, females-81.57%).

Table 10. Statistical results of the study

Sensitivity	94.4%
Speficity	78.2%
Positive predictive value	83.6%
Negative appendicectomy rate	15.6%

Table 11. Final Diagnosis (Operative Findings + Histopathology)

Findings	No of patients	Percentage
Acute appendicitis	43	67.2
Perforated appendix	5	7.8
Gangrenous appendix	7	10.9
Ruptured ovarian cyst	2	3.1
Salphingitis	1	1.6
No pathology found	6	9.4
Total operated patient	64	100

Table 11. Final Diagnosis (Operative Findings + Histopathology)

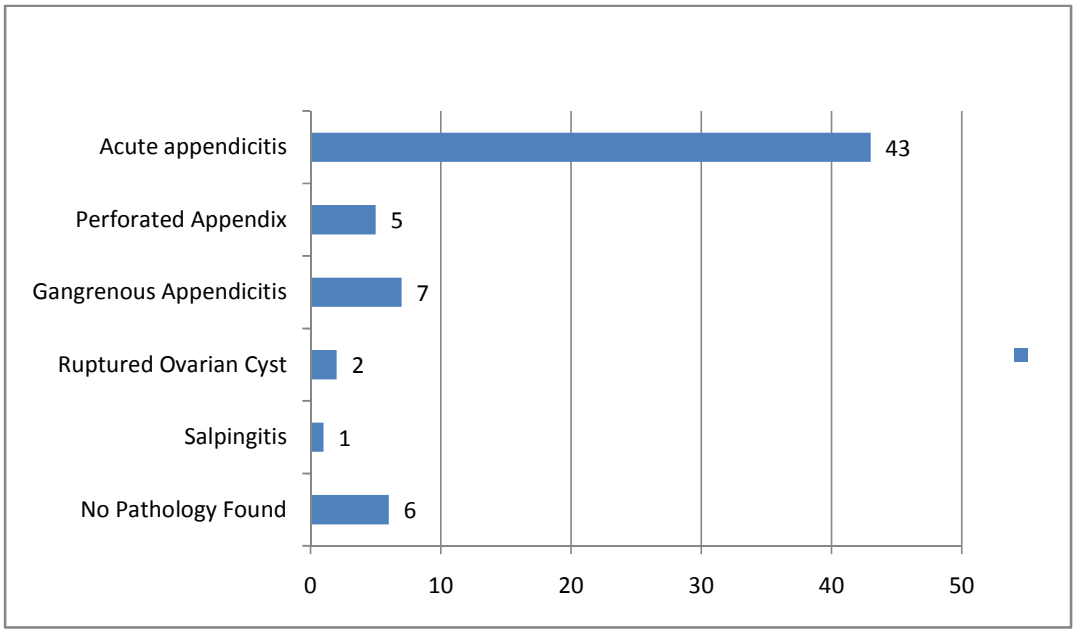
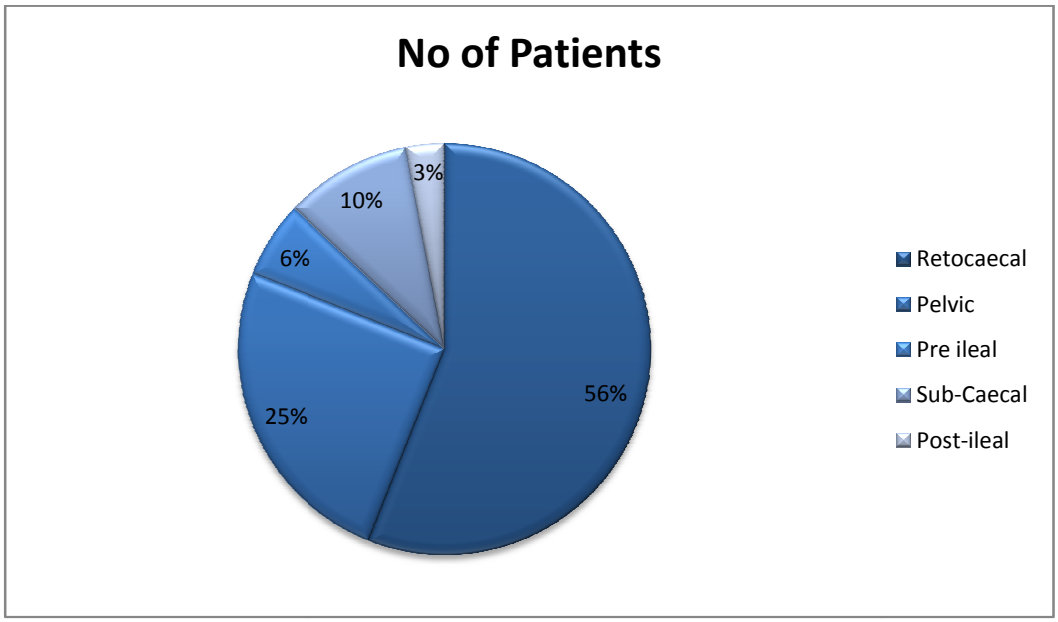


Table No. 12 Position of appendix according to operative findings

Position of the appendix	No of the patients	Percentage
Retrocaecal	36	57
Pelvic	16	25
Pre - illeal	04	06
Sub – caecal	06	09
Post - illeal	02	03

Graph No. 11. Position of appendix according to operative findings



DISCUSSION

Acute Appendicitis is the most common acute surgical condition of the abdomen. Over past 100 years, the morbidity and mortality rates related to this condition have markedly decreased. This is because of the recognition of deleterious effects of appendiceal perforation.

Thus an aggressive surgical treatment strategy involving early operation with acceptance of a high negative appendicectomy rate of15% to 30% is universal. Although the negative appendicectomy has negligible mortality, it has associated morbidity rate of 10%. The diagnostic accuracy of clinical assessment of acute appendicitis varies from50%-80%.

The series from US Naval Hospital, San Diego, California, revealed an accuracy of 87%. The clinical diagnosis is especially difficult in the very young, the elderly and in the women of reproductive age group.

Appendicitis still poses a diagnostic challenge and many methods have been investigated to try to reduce the removal of a normal appendix without increasing the perforation rate. Radiological methods such as ultrasonography and computed tomography, as well as invasive procedure like laparoscopy are all methods that have been investigated previously. Many diagnostic scores have seen advocated but most are

complex and difficult to implement in a clinical situation. The Alvarado score, first described in1988, is a simple scoring system.

Good clinical acumen remains the mainstay of correct diagnosis of appendicitis. It is a scoring system that can be instituted easily in the outpatient setting and a cheap and quick tool to apply in the emergency room Alvarado Score is an objective assessment of right lower quadrant pain. The score indicated $\geq$ 7 indicates high probability of acute appendicitis. Practically speaking, it is equivalent to one's degree of clinical suspicion.

Therefore this scoring system was used to reach the clinical diagnosis. It was considered that use of the scoring system to make the clinical diagnosis would allow uniformity as more than one senior surgical resident were involved in making the decision. In this study, the youngest patient was 10 years and the oldest being 64 years. Men accounted for 41% and women 59% of the study group. The maximal incidence of acute appendicitis was found between the ages 21-30 years which is comparable with the literature.

In the study by Ohmannet al[45]and Arian GM[56]the negative appendicectomy rate was 14.3% and 16.1% respectively. In this study

the negative appendicectomy rate was 15.6% with the rate being higher in females (17.9%) than males (12%). Removal of some normal appendices is bound to lower the rate of perforation and consequent mortality.

Literature shows that if negative appendicectomy rate is less than 10-15%, then the surgeon is operating on too few patients thus increasing the risk of complications. Some centers have even reduced negative appendicectomy rates to less than 10% by having regular audit of appendicectomies. In the present study the perforation rate was 7.8% and all the 5 cases of perforative appendicitis had scores 7 or more and were subjected to surgery thereby giving a 0% missed perforation rate.

Ohmann.C et al[45]in their study on diagnostic scores for acute appendicitis measured the main outcome of Alvarado score and showed a initial negative appendicectomy rate less than 15%, perforation rate less than 35% and a missed perforation rate less than 5%. The results of our study are comparable to that of Ohmann C et al.[45] The missed appendicitis rate in our study was 5.5%.

The 3 cases which were missed initially came back with increased severity of symptoms and had a higher Alvarado score on re-evaluation and were operated. The probable reason for the 3 false negatives in our study may be the very early stage of acute appendicitis they might have presented initially, thereby hindering the clinical diagnosis.

In this study the sensitivity, specificity and positive predictive value were 94.4%, 78.2% and 83.6% respectively. The positive predictive value was 86.95% in males as compared to 81.57% in females, resulting in higher diagnostic accuracy in males. This study also shows that application of Alvarado scoring system in the diagnosis of acute appendicitis can provide a high degree of positive predictive value and thus diagnostic accuracy. Positive predictive value shown by this study is comparable with the studies done by M Kalan,[20] K.A. Malik[57] and T.D.Owen[2] who reported 87.5%, 85.3% and 87.4% respectively.

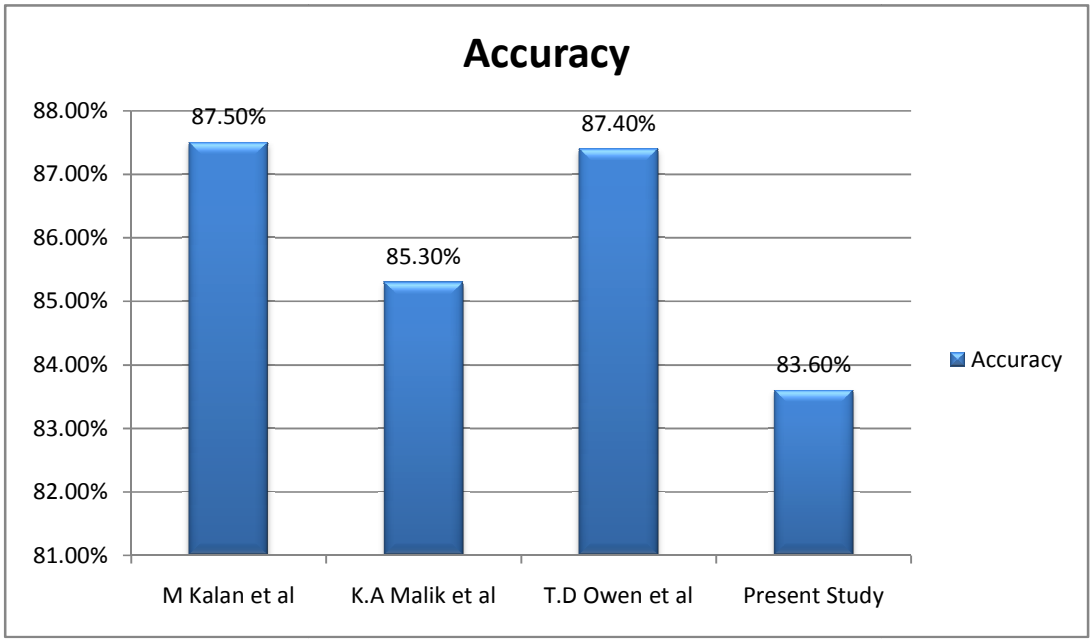
This study also revealed that Alvarado scoring system is more helpful in male patients by showing lower negative appendicectomy rate and high positive predictive value for male patients as compared to females.

In females additional investigations and even a diagnostic laparoscopy may be helpful to confirm the diagnosis of acute appendicitis as supported by the study conducted by Lamprealliet al[59]as a prospective evaluation of the combined use of the modified Alvarado score with selective laparoscopy in adult females. The negative appendicectomy rate in females came down to 0% with the use of laparoscopy in their study[59]. Other studies also support this observation.

Table 13 Comparitive analysis of accuracy

Authors	Year	No of patients	Accuracy
M Kalam et al	1994	125	87.5%
K.A Malik et al	2000	148	85.3%
T.D Owen et al	1992	215	87.4%
Present study	2014	100	83.6%

Table 13 Comparitive analysis of accuracy



SUMMARY

Hundred cases with a clinical diagnosis of acute appendicitis were studied for alvarado scoring system from Janaury 2014 to September 2014. In this study, 41 patients (41%) were male and 59 patients (59%) were female. In this study, maximum patients were from age group 21-30 years who accounted for (42 %) followed by 10-20 years age group (31%) and least number of patients in the 61-70 years age group (1%)

There were 17 patients with Alvarado score 1 – 4 with 10 females (58.8%) and 7 males (41.2%). 18 %of the patients with the score 1 – 4 underwent appendicectomy with histopathological report of inflamed appendix. Of them 2were male (66.6%) and1female (33.3%). There were31patients (31%) with Alvarado score 5-6 with 17 females (54.8%) and 14 males (45.2%).

9 Patients (29%) with a score of 5-6 underwent appendicectomy with histopathological report of inflamed appendix in 7 patients (77.7%) with 2 males and 5females, and normal appendix in 2 patients (22.2%).

In 52 patients (52%) the score was 7 – 10 with 32 females (61.5%) and 20 males (38.5%). 52patients (100%) underwent appendicectomy. The histopathology showed inflamed appendix in 45 patients (86.5%) with 19 males and 26females, and normal appendix in 7patients (13.4%).

CONCLUSION

In the present study we had 100 cases out of which 41 were males and 59 were females. In this study 64 were operated and acute appendicitis was found in 54 patients including 32 female patients and 22 male patients. So to conclude

- Alvarado Scoring System has a high sensitivity and Positive predictive value.

- This scoring system is a dynamic one, allowing observation and critical re-evaluation of the evolution of the clinical picture.

- Its value in decision making is high both in males and females. However in females because infection is multifactorial in origin, diagnostic laparoscopy is essential.

- If possible should be done before scheduling for surgery to minimize the high negative appendicectomy rate.

- Its application improves diagnostic accuracy and consequently reduces negative exploration and complication rates.

- This scoring system is quick and cost effective and it can be useful in any district hospitals or day care centre as an adjunct to clinical diagnosis.

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CONSENT FORM

I _____ hereby give consent to participate in the study conducted by **DR.M.Jedidiah Samraj. ,** Post graduate in the Department of General Surgery ,Thanjavur Medical College & Hospital, Thanjavur – 613004 and to use my personal, clinical data and result of investigation for the purpose of analysis and to study the nature of disease. I also give consent for further investigations

Place :

Date : Signature of participant

PROFORMA

Name	Age/sex	Ip no:
DOA:	DOS:	DOD:

Hospital:

Complaints:

Present History:

H/o abdominal pain

H/o vomiting

H/o fever

H/o anorexia

H/o diarrhea

H/o constipation

Past history:

Previous H/o hypertension, tuberculosis, diabetes mellitus.

Previous H/o surgery

Previous H/o similar episodes

Personal H/o :

Smoking/ Alcoholism/ Betel nut chewer

Menstrual History in Female

General Examination:

Built & nourishment:	Pallor:	Temperature:
PR:	BP:	RR:

Systemic Examination:

CVS	RS	Others

Abdomen examination:

Localised tenderness

Rebound tenderness

Distension

Guarding and rigidity

Bowel sounds

External Genitalia:

Per Rectal Examination:

Investigations:

Hb% Total count: DC:

B.Urea B.Sugar Sr.Creatinine:

ECG:

X ray Chest: X ray abdomen:

Urine:

Alb sugar Deposits

Anaesthesia:

Surgery:

Post operative period:

Complications:

Follow up:

Histopathological Examination Report:

KEYS TO MASTER CHART

PAIN ABDOMEN : P

FEVER :F

ANOREXIA :A

VOMITING :V

NAUSEA :N

POSTIVE +

NEGATIVE -

HISTO PATHOLOGICAL EXAMINATION REPOR – HPE

S. NO	NAME	AGE/ SEX	IP .NO	COMPLAINTS	T^	LOCALIZED TENDERNESS	REBOUND TENDERNESS	GUARDING RIGIDITY	TOTAL WBC COUNT	HPE REPORT
1	ARULANANDHAM	19/M	35621	P.V.A	+	+	+	_	10600	INFLAMMED APPENDIX
2	MANIMEGALAI	26/F	35124	P.N.A	_	+	+	+	12480	INFLAMMED APPENDIX
3	HEMALADHA	22/F	45123	P.V.A	+	+	+	_	9430	INFLAMMED APPENDIX
4	RAJKUMAR	30/M	35641	P.A	+	+	+	+	8890	INFLAMMED APPENDIX
5	MARIAMMAL	26/F	36478	P	+	+	_	_	9960	INFLAMMED APPENDIX
6	RAMESH	24/M	36589	P.V.A	+	+	_	_	11400	INFLAMMED APPENDIX
7	VANATHI	21/F	35698	P.N.A	+	+	+	+	7340	INFLAMMED APPENDIX
8	KALAMANI	22/F	35478	P.V.A	_	+	+	_	8952	INFLAMMED APPENDIX
9	SHANMUGAPRIYA	26/F	36589	P.A	+	+	+	+	8980	INFLAMMED APPENDIX
10	ARUNKUMAR	25/M	37896	P	+	+	+	_	7340	INFLAMMED APPENDIX
11	RAJKUMAR	26/M	37854	P.V.A	+	+	+	_	9430	INFLAMMED APPENDIX
12	PRIYA	23/F	35471	P.N.A	+	+	+	_	9960	INFLAMMED APPENDIX
13	JANAKI	24/F	39874	P.V.A	_	+	_	_	9440	INFLAMMED APPENDIX
14	SASIKALA	20/F	38547	P.A	+	+	_	_	9206	INFLAMMED APPENDIX
15	JAYALALITHA	20/F	38547	P	+	+	+	+	8890	INFLAMMED APPENDIX
16	MOHAN	27/M	41236	P.V.A	+	+	+	_	10780	INFLAMMED

										APPENDIX
17	HARRIS	17/M	45632	P.N.A	+	+	+	+	12980	NORMAL APPENDIX
18	SOLOMON	14/M	42544	P.V.A	+	+	+	_	9434	INFLAMMED APPENDIX
19	MOHAMAD RIYAZ	29/M	43254	P.A	_	+	+	+	8890	INFLAMMED APPENDIX
20	SATHIYA	22/M	42563	P	+	+	_	_	9960	INFLAMMED APPENDIX
21	SIMON	19/M	41254	P.V.A	+	+	_	_	11340	INFLAMMED APPENDIX
22	ANBUSELVI	26/F	41785	P.N.A	+	+	+	+	7340	INFLAMMED APPENDIX
23	MADHUSUDHAN	23/F	41954	P.V.A	+	+	+	_	8967	INFLAMMED APPENDIX
24	BHUVANESHWARI	22/F	42584	P.A	+	+	+	+	8923	INFLAMMED APPENDIX
25	MUNIYAN	31/M	42632	P	_	+	+	_	7340	INFLAMMED APPENDIX
26	MANI	26/M	42858	P.V.A	+	+	+	_	9457	RUPTURED OVARIAN CYST
27	PONNUSAMY	33/M	41151	P.N.A	+	+	+	_	9960	INFLAMMED APPENDIX
28	PONNAMAL	16/F	41154	P.V.A	+	+	_	_	9478	INFLAMMED APPENDIX
29	MARIYAMMAL	20/M	39825	P.A	+	+	_	_	9206	NORMAL APPENDIX
30	RANI	22/F	35845	P	_	+	+	+	8898	INFLAMMED APPENDIX
31	JAYAKATHIRAVAN	27/M	35555	P.V.A	+	+	+	_	10670	NORMAL APPENDIX
32	MANGAMMA	22/F	36666	P.N.A	+	+	+	+	12480	INFLAMMED APPENDIX
33	ANBALAGAN	25/M	41111	P.V.A	+	+	+	_	9434	INFLAMMED

										APPENDIX
34	DHARMARAJ	34/M	43256	P.A	+	+	+	+	8890	NORMAL APPENDIX
35	KAVITHA	22/F	43333	P	+	+	_	_	9934	INFLAMMED APPENDIX
36	GANESH	19/M	41752	P.V.A	_	+	_	_	11650	INFLAMMED APPENDIX
37	REKHA	28/F	42224	P.N.A	+	+	+	+	7356	INFLAMMED APPENDIX
38	THAMARAISELVI	24/F	43336	P.V.A	+	+	+	_	8952	INFLAMMED APPENDIX
39	ROOMATHI	22/F	43318	P.A	+	+	+	+	8934	INFLAMMED APPENDIX
40	SUBRAMANIYAN	28/M	42517	P	+	+	+	_	7323	RUPTURED OVARIAN CYST
41	RAJALAKSHMI	26/F	36524	P.V.A	+	+	+	_	9430	INFLAMMED APPENDIX
42	MALIKA	24/F	39986	P.N.A	_	+	+	_	9912	NORMAL APPENDIX
43	CHINNAMMAL	48/F	39874	P.V.A	+	+	_	_	9440	INFLAMMED APPENDIX
44	BHAKIYALAKSHMI	20/F	39393	P.A	+	+	_	_	9267	SALPHINGITIS
45	MARIYAPPAN	28/M	36546	P	+	+	+	+	8890	INFLAMMED APPENDIX
46	RAVI	20/M	38798	P.V.A	+	+	+	_	10780	INFLAMMED APPENDIX
47	SUGANYA	30/F	39852	P.N.A	_	+	+	+	12480	NORAMAL APPENDIX
48	KANNAN	19/M	37147	P.V.A	+	+	+	_	9498	INFLAMMED APPENDIX
49	JAYAPAL	32/M	37666	P.A	+	+	+	+	8890	INFLAMMED APPENDIX
50	KARTHIK	23/M	41416	P	+	+	_	_	9954	INFLAMMED

										APPENDIX
51	PRABHU	46/M	41417	P.V.A	+	+	_	_	11450	INFLAMMED APPENDIX
52	RAJA	45/M	41418	P.N.A	+	+	+	+	7340	INFLAMMED APPENDIX
53	AMUDHAN	3/M	41214	P.V.A	_	+	+	_	8945	INFLAMMED APPENDIX
54	KALAIVANI	31/F	42428	P.A	+	+	+	+	8980	INFLAMMED APPENDIX
55	JAYARANI	35/F	45459	P	+	+	+	_	7356	INFLAMMED APPENDIX
56	KAVITHA	24/F	46469	P.V.A	+	+	+	_	9430	NORMAL APPENDIX
57	NEELA	32/F	43438	P.N.A	+	+	+	_	9967	INFLAMMED APPENDIX
58	MEGHALA	26/F	44445	P.V.A	+	+	_	_	9440	INFLAMMED APPENDIX
59	RAMYA	17/F	41418	P.A	_	+	_	_	9278	INFLAMMED APPENDIX
60	MEENAKSHI	29/F	42264	P	+	+	+	+	8890	INFLAMMED APPENDIX
61	SOWMYA	30/F	43356	P.V.A	+	+	+	_	10890	INFLAMMED APPENDIX
62	PRATHIBA	25/F	45514	P.N.A	+	+	+	+	12480	INFLAMMED APPENDIX
63	KALAVATHI	19/F	44224	P.V.A	+	+	+	_	9498	INFLAMMED APPENDIX
64	CHINNAMAL	32/F	39393	P.A	_	+	+	+	8890	INFLAMMED APPENDIX
65	JANANI	22/F	36356	P	+	+	_	_	9956	INFLAMMED APPENDIX
66	SRIRANJANI	45/F	37378	P.V.A	+	+	_	_	11400	INFLAMMED APPENDIX
67	BABU	56/M	38389	P.N.A	+	+	+	+	7345	INFLAMMED

										APPENDIX
68	SAHUL HAMEED	24/M	39391	P.V.A	+	+	+	_	8952	INFLAMMED APPENDIX
69	VENILA	20/F	36363	P.A	+	+	+	+	8945	INFLAMMED APPENDIX
70	ANANDHARAJ	30/M	39879	P	_	+	+	_	7340	INFLAMMED APPENDIX
71	MALARVIZHI	27/F	39395	P.V.A	+	+	+	_	9434	INFLAMMED APPENDIX
72	JANAKI	22/F	39398	P.N.A	+	+	+	_	9960	INFLAMMED APPENDIX
73	NAGARAJAN	33/M	39399	P.V.A	+	+	_	_	9486	INFLAMMED APPENDIX
74	AROKIYADAS	19/M	40401	P.A	+	+	_	_	9206	INFLAMMED APPENDIX
75	CHANDRA	29/F	40425	P	+	+	+	+	8867	INFLAMMED APPENDIX
76	KUMAR	35/M	40562	P.V.A	_	+	+	_	10600	INFLAMMED APPENDIX
77	NANDHINI	22/F	40852	P.N.A	+	+	+	+	12870	INFLAMMED APPENDIX
78	SHADHIK BASHA	35/M	40896	P.V.A	+	+	+	_	9437	INFLAMMED APPENDIX
79	MARUDHUPANDI	45/M	408754	P.A	+	+	+	+	8890	INFLAMMED APPENDIX
80	SUNDHAR	31/M	40852	P	+	+	_	_	9968	INFLAMMED APPENDIX
81	NOORJAHAN	60/F	42405	P.V.A	_	+	_	_	11490	INFLAMMED APPENDIX
82	MUTHUMANI	33/M	43405	P.N.A	+	+	+	+	7347	INFLAMMED APPENDIX
83	SELVI	18/F	44405	P.V.A	+	+	+	_	8956	INFLAMMED APPENDIX
84	GURUMOORTHY	23/M	46405	P	+	+	+	+	8985	INFLAMMED

										APPENDIX
85	RAJESH	22/M	47414	P.V	+	+	+	_	7343	INFLAMMED APPENDIX
86	SARABESAN	35/M	34658	P	+	+	+	_	9432	INFLAMMED APPENDIX
87	MURUGAN	18/M	36524	P.A	_	+	+	_	9962	INFLAMMED APPENDIX
88	AKILA	22/F	36985	P	+	+	_	_	9446	INFLAMMED APPENDIX
89	BANUMATHI	33/F	36352	P	+	+	_	_	9207	INFLAMMED APPENDIX
90	KARTHIKEYAN	22/M	32145	P	+	+	+	+	8898	INFLAMMED APPENDIX
91	JAYANDHAN	28/M	38745	P	+	+	+	_	10690	INFLAMMED APPENDIX
92	SUBA	35/F	39658	P.A	+	+	+	+	12490	INFLAMMED APPENDIX
93	MANIVEL	27/M	40548	P.V.A	_	+	+	_	9430	INFLAMMED APPENDIX
94	GANDHI	23/M	40987	P.V.A	+	+	+	+	8893	INFLAMMED APPENDIX
95	MANI	60/M	40852	P.N.V	+	+	_	_	9963	INFLAMMED APPENDIX
96	SATHIYA	35/M	40752	P	+	+	_	_	11440	INFLAMMED APPENDIX
97	SENTHILKUMAR	32/M	40874	P.N.V	+	+	+	+	7322	INFLAMMED APPENDIX
98	KASTHURI	24/F	40101	P.N	_	+	+	_	8911	INFLAMMED APPENDIX
99	SIVAPRAKASAM	23/M	40120	P	+	+	+	+	8955	INFLAMMED APPENDIX
100	KALIYAPERUMAL	35/M	40150	P	+	+	+	_	7366	INFLAMMED APPENDIX